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# Operation and Maintenance Costs for Municipal Wastewater Facilities

(U.S.) Environmental Protection Agency
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# Technical Report

# Operation and Maintenance Costs for Municipal Wastewater Facilities

|  | OPERATION |  |  |  |  |  | MAINTENANCE |  |  |  | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | SALARIES & WAGES | EMPLOYEE BENEFITS | MATERIALS & SUPPLIES | POWER & LIGHT | MISCEL-LANEOUS | SUB TOTAL OPERATION | SALARIES & WAGES | EMPLOYEE BENEFITS | MATE-RIALS & SUPPLIES | SUB TOTAL MAINTE-NANCE | OPERATION & MAINTE-NANCE |
| tment | $1,192,473 | $252,135 | $1,551,462 | $ 780,709 | – | $3,776,779 | $ 593,304 | $125,448 | $249,188 | $ 967,940 | $4,744,719 |
| n Pumping | 200,228 | 42,335 | 18,512 | 209,662 | – | 470,737 | 57,238 | 12,128 | 46,740 | 116,106 | 586,843 |
| oratory | 130,446 | 27,581 | 17,751 | 694 | – | 176,472 | 4,942 | 1,036 | 594 | 6,572 | 183,044 |
| r Survey & Industrial Wastes | 73,386 | 15,514 | 3,111 | 580 | – | 92,591 | 22 | – | 2 | 24 | 92,615 |
| rcepting Sewer System | – | – | 2,972 | 6,061 | – | 9,033 | 263,036 | 55,612 | 43,702 | 362,350 | 371,383 |
| er Allegheny System | – | – | 43 | 8,777 | – | 8,820 | 24,804 | 5,241 | 4,220 | 34,265 | 43,085 |
| ng & Collecting | 360,076 | 76,153 | 32,314 | 4,888 | $207,733 | 681,164 | 5,332 | 1,124 | 164 | 6,620 | 687,784 |
| neering | 179,112 | 37,873 | 6,752 | 1,447 | 34,503 | 259,687 | 69 | – | 6 | 75 | 259,762 |
| ninistration & General | 261,830 | 55,416 | 73,375 | 1,270 | 125,151 | 517,042 | 94,202 | 19,912 | 19,237 | 133,351 | 650,393 |
| al Operating Expenses—1974<br>ercent of Total | 2,397,551<br>31.5 | 507,007<br>6.6 | 1,706,292<br>22.4 | 1,014,088<br>13.3 | 367,387<br>4.8 | 5,992,325<br>78.6 | 1,042,949<br>13.8 | 220,501<br>2.9 | 363,853<br>4.7 | 1,627,303<br>21.4 | 7,619,628<br>100.0 |
| al Operating Expenses—1973<br>ercent of Total | 2,065,646<br>37.4 | 418,282<br>7.6 | 954,845<br>17.3 | 457,197<br>8.3 | 366,445<br>6.6 | 4,262,415<br>77.2 | 855,311<br>15.5 | 179,691<br>3.3 | 221,827<br>4.0 | 1,256,829<br>22.8 | 5,519,244<br>100.0 |
| al Operating Expenses—1972<br>ercent of Total | 1,706,988<br>37.3 | 348,972<br>7.6 | 878,859<br>19.2 | 323,483<br>7.1 | 275,835<br>6.0 | 3,534,137<br>77.2 | 750,132<br>16.4 | 153,146<br>3.4 | 137,525<br>3.0 | 1,040,803<br>22.8 | 4,574,940<br>100.0 |
| al Operating Expenses—1971<br>ercent of Total | 1,586,838<br>40.1 | 257,278<br>6.5 | 669,868<br>16.9 | 286,812<br>7.2 | 262,706<br>6.6 | 3,063,502<br>77.3 | 647,883<br>16.4 | 104,497<br>2.6 | 146,224<br>3.7 | 898,604<br>22.7 | 3,962,106<br>100.0 |
| al Operating Expenses—1970<br>ercent of Total | 1,389,711<br>39.8 | 285,348<br>8.2 | 522,648<br>15.0 | 246,387<br>7.0 | 263,730<br>7.5 | 2,707,824<br>77.5 | 549,136<br>15.7 | 112,739<br>3.2 | 124,228<br>3.6 | 786,103<br>22.5 | 3,493,927<br>100.0 |
| ear Avg. Operating Expenses<br>ercent of Total | 1,829,348<br>36.3 | 363,377<br>7.2 | 946,502<br>18.8 | 465,593<br>9.3 | 307,221<br>6.1 | 3,912,041<br>77.7 | 769,082<br>15.3 | 154,115<br>3.1 | 198,731<br>3.9 | 1,121,928<br>22.3 | 5,033,969<br>100.0 |
|  |  |  |  | Breakdown of Treatment Expenses |  |  |  |  |  |  |  |
| eening & Grit Removal | 185,995 | 39,344 | 27,717 | 2,082 | – | 255,138 | 37,637 | 7,960 | 8,776 | 54,373 | 309,511 |
| aeration & Sedimentation | 178,912 | 37,823 | 9,376 | 3,585 | – | 229,696 | 73,554 | 15,546 | 14,143 | 103,243 | 332,939 |
| ondary Treatment | 190,350 | 40,256 | 181,152 | 529,243 | – | 941,001 | 72,673 | 15,370 | 14,771 | 102,814 | 1,043,815 |
| uum Filtration | 314,296 | 66,418 | [illegible] | [illegible] | [illegible] | [illegible]180 | 108,368 | 22,911 | 43,763 | 175,042 | 1,248,222 |

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The three technical reports listed below were prepared in conjunction with the 1980 Update of Needs for Municipal Wastewater Treatment Facilities, a biennial report to the U.S. Congress. This series of reports provides construction cost relationships and also related operations and maintenance (O&M) cost relationships for existing facilities. The data base for all three studies is representative of the ten regions.

| Document Number | Title |
|---|---|
| 430/9-80-003<br>FRD-11 | Construction Costs for Municipal Wastewater Treatment Plants: 1973-1978 |
| 430/9-81-003<br>FRD-21 | Construction Costs for Municipal Wastewater Conveyance Systems: 1973-1979 |
| 430/9-81-004<br>FRD-22 | Operation and Maintenance Costs for Municipal Wastewater Treatment Systems |

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This report presents the results of the latest and most comprehensive effort to obtain and analyze O&M costs for wastewater treatment works. It summarizes data from more than 900 treatment plants and almost 500 conveyance systems throughout 40 of the 48 contiguous United States, including all ten EPA regions. Included is information on administrative costs, sludge handling costs, and staffing.

The basic information for this report was obtained from visits to selected sites, and from earlier studies. This basic information was combined into a simple data base, and examined for relationships between total O&M costs, facility design parameters and plant operation parameters. These relationships were developed for the general national level and, where possible, for smaller geographic units. Where appropriate in analyzing the data, total O&M costs were reduced to their major components.

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TECHNICAL REPORT

# OPERATION & MAINTENANCE COSTS FOR MUNICIPAL WASTEWATER FACILITIES

SEPTEMBER 1981

Prepared For

U. S. ENVIRONMENTAL PROTECTION AGENCY
FACILITY REQUIREMENTS DIVISION
WASHINGTON, D. C. 20460

Project Officer: Dr. Wen H. Huang

## TABLE OF CONTENTS

Page

1.0 INTRODUCTION

Background 1-1
Purpose 1-2
Objectives 1-2
Approach 1-2
Scope 1-3

2.0 DEFINITIONS AND PROCEDURES

Introduction 2-1
Definition of Terms 2-1
Data Collection Procedures 2-5
Cost Updating Procedures 2-10
Data Analysis and Presentation 2-12

3.0 FINDINGS

Introduction 3-1
Treatment Plants 3-2
Conveyance Systems 3-68

4.0 DATA UTILIZATION

Introduction 4-1
Example Problem 4-1
Cost Updating 4-2

REFERENCES R-1

APPENDIX A - LIST OF WASTEWATER CONTROL FACILITIES IN THE DATA BASE A-1

# LIST OF TABLES

Page

2.1 Summary of Treatment Plant Information Items 2-7

2.2 Summary of Sewer System Information Items 2-9

2.3 Distribution of Plants and Sewers by EPA Region and Level of Treatment 2-11

2.4 Wastewater Treatment Facility O&M Cost Updating Indexes 2-13

2.5 Wastewater Conveyance System O&M Cost Updating Indexes 2-14

3.1 Comparison of Annual Administrative Costs to Annual Total O&M Costs for Wastewater Treatment Plants 3-9

3.2 Secondary Treatment Sludge Handling Methods 3-16

3.3 Advanced Secondary Treatment Sludge Handling Methods 3-31

3.4 Advanced Wastewater Treatment Sludge Handling Methods 3-36

3.5 Comparison of Statistical Information From Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plant Data 3-42

3.6 Major Component Costs as a Percentage of Total O&M Costs 3-46

3.7 Number of Facilities According to Hydraulic Loading 3-59

3.8 BOD Removal (mg/l) According to Hydraulic Loading 3-59

3.9 Suspended Solids Removal (mg/l) According to Hydraulic Loading 3-59

3.10 Total Annual O&M Costs/Million Gallons According to Hydraulic Loading 3-61

3.11 Total Annual O&M Costs/Pound of BOD Removed According to Hydraulic Loading 3-61

3.12 Total Annual O&M Costs/Pound of SS Removed According to Hydraulic Loading 3-61

3.13 Most Frequently Reported Wastewater Treatment O&M Problems 3-62

3.14 Component Costs as a Percentage of Total O&M Costs for Conveyance Systems 3-74

LIST OF TABLES (Concluded)

Page

4.1 Example - Wastewater Treatment Facility Annual O&M Estimates 4-3

4.2 Example - Conveyance System Annual O&M Estimates 4-4

4.3 Example - Total Annual O&M Cost and Staffing Estimates 4-4

4.4 Wastewater Charges for Select Cities 4-6

A.1 List of Wastewater Treatment Plants A-2

A.2 List of Conveyance Systems A-17

## LIST OF FIGURES

Page

3.1 Administrative Costs vs Design Flow - Comparison: Treatment Levels - Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plants 3-5

3.2 Administrative Costs vs Design Flow - All Treatment Level Composite - Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plants 3-6

3.3 Total O&M Costs vs Design Flow - Secondary Wastewater Treatment Plants 3-10

3.4 Total O&M Costs vs Design Flow - Comparison: Literature Values - Secondary Wastewater Treatment Plants 3-11

3.5 Total O&M Costs vs Design Flow - Comparison: CAPDET Values - Secondary Wastewater Treatment Plants 3-13

3.6 Total O&M Costs vs Design Flow - Comparison: Sludge Handling Complexity - Secondary Wastewater Treatment Plants 3-15

3.7 Total O&M Costs vs Design Flow - EPA Region 1 - Secondary Wastewater Treatment Plants 3-17

3.8 Total O&M Costs vs Design Flow - EPA Region 2 - Secondary Wastewater Treatment Plants 3-18

3.9 Total O&M Costs vs Design Flow - EPA Region 3 - Secondary Wastewater Treatment Plants 3-19

3.10 Total O&M Costs vs Design Flow - EPA Region 4 - Secondary Wastewater Treatment Plants 3-20

3.11 Total O&M Costs vs Design Flow - EPA Region 5 - Secondary Wastewater Treatment Plants 3-21

3.12 Total O&M Costs vs Design Flow - EPA Region 6 - Secondary Wastewater Treatment Plants 3-22

3.13 Total O&M Costs vs Design Flow - EPA Region 7 - Secondary Wastewater Treatment Plants 3-23

3.14 Total O&M Costs vs Design Flow - EPA Region 8 - Secondary Wastewater Treatment Plants 3-24

3.15 Total O&M Costs vs Design Flow - EPA Region 9 - Secondary Wastewater Treatment Plants 3-25

3.16 Total O&M Costs vs Design Flow - EPA Region 10 - Secondary Wastewater Treatment Plants 3-26

## LIST OF FIGURES (Continued)

Page

3.17 Total O&M Costs vs Design Flow - Advanced Secondary Wastewater Treatment Plants 3-28

3.18 Total O&M Costs vs Design Flow - Comparison: CAPDET Values - Advanced Secondary Wastewater Treatment Plants 3-29

3.19 Total O&M Costs vs Design Flow - Comparison: Sludge Handling Complexity - Advanced Secondary Wastewater Treatment Plants 3-30

3.20 Total O&M Costs vs Design Flow - Advanced Wastewater Treatment Plants 3-33

3.21 Total O&M Costs vs Design Flow - Comparison: CAPDET Values - Advanced Wastewater Treatment Plants 3-34

3.22 Total O&M Costs vs Design Flow - Comparison: Sludge Handling Complexity - Advanced Wastewater Treatment Plants 3-35

3.23 Total O&M Costs vs Design Flow - Comparison: Treatment Levels - Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plants 3-38

3.24 Total O&M Costs vs Design Flow - Comparison: Treatment Levels, $Q_D \leq 1.0$ mgd - Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plants 3-39

3.25 Total O&M Costs vs Design Flow - Comparison: Treatment Levels, $Q_D > 1.0$ mgd - Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plants 3-40

3.26 Total O&M Costs vs Design Flow - All Treatment Level Composite - Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plants 3-41

3.27 Sludge Handling Costs vs Actual Plant Flow - All Treatment Level Composite - Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plants 3-44

3.28 Sludge Handling Costs vs Solids Production - All Treatment Level Composite - Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plants 3-45

3.29 Staff Size vs Design Flow - Secondary Wastewater Treatment Plants with Literature Comparisons 3-48

## LIST OF FIGURES (Continued)

Page

3.30 Staff Size vs Design Flow - Advanced Secondary Wastewater Treatment Plants with Literature Comparisons 3-50

3.31 Staff Size vs Design Flow - Advanced Wastewater Treatment Plants with Literature Comparisons 3-52

3.32 Staff Size vs Design Flow - Comparison: Treatment Levels - Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plants 3-53

3.33 Staff Size vs Design Flow - All Treatment Level Composite - Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plants 3-54

3.34 Total O&M Costs vs Design Flow - Comparison: Hydraulic Loading Ranges - Secondary Wastewater Treatment Plants 3-55

3.35 Total O&M Costs vs Design Flow - Comparison: Hydraulic Loading Ranges - Advanced Secondary Wastewater Treatment Plants 3-56

3.36 Total O&M Costs vs Design Flow - Comparison: Hydraulic Loading Ranges - Advanced Wastewater Treatment Plants 3-57

3.37 ABC Classification of Wastewater Treatment Plants (WWT) 3-64

3.38 ABC Wastewater Treatment Plant Classification - Variable Point Guide 3-65

3.39 Total O&M Costs vs ABC Rating - All Treatment Level Composite - Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plants 3-66

3.40 Staff Size vs ABC Rating - All Treatment Level Composite - Secondary, Advanced Secondary, and Advanced Wastewater Treatment Plants 3-67

3.41 Total O&M Costs vs Service Population - Sewer Systems With Lift Stations 3-69

3.42 Total O&M Costs vs Service Population - Sewer Systems Without Lift Stations 3-70

3.43 Total O&M Costs vs Length of Pipe - Sewer Systems With Lift Stations 3-71

3-44 Total O&M Costs vs Length of Pipe - Sewer Systems Without Lift Stations 3-72

LIST OF FIGURES (Concluded)

Page

3-45 Staff Hours vs Service Population - Sewer Systems With Lift Stations 3-75

3-46 Staff Hours vs Service Population - Sewer Systems Without Lift Stations 3-76

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Sincere appreciation is extended to EPA Construction Grants personnel in each of the ten Regions and to the many State and local officials who contributed their experience, advice, and counsel to this task. A special thanks is extended to the municipal wastewater control facility personnel--more than a thousand of them--who took the time to provide the data and information on which this report is based.

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# EXECUTIVE SUMMARY

Successful operation and maintenance (O&M) of wastewater control facilities is essential to the attainment of this nation's clean water goals. It is also an expensive undertaking, equal in magnitude over the life of the facility, to the cost of its construction. For these reasons EPA's Construction Grants Program examines and, if appropriate, approves the projected O&M costs for proposed wastewater control facilities. To facilitate this determination EPA continually collects and maintains data on O&M costs for municipal wastewater treatment works. Currently data on the O&M costs for separate sewer systems, and for secondary, advanced secondary, and advanced wastewater treatment plants served by separate sewer systems are of special concern. This report presents the results of the latest and most comprehensive effort to obtain and analyze O&M costs for these kinds of facilities. It summarizes O&M data from more than 900 treatment plants and almost 500 conveyance systems throughout 41 of the 48 contiguous United States--including all ten EPA Regions. Included is information on administrative costs, sludge handling costs, and staffing.

The basic information for this report was obtained from visits to selected sites and from earlier studies. It was combined into a single data base, and examined for relationships between O&M costs and common facility design and operating parameters. These relationships were determined for the general national case and, where possible, for smaller geographic units. Where appropriate in analyzing the data, total O&M costs were reduced to their major components such as personnel, utilities, chemicals, materials, equipment, and contractual.

Among the more significant findings are:

- O&M cost recordkeeping procedures are less than adequate for many facilities. For example, complete O&M cost data were available for only 60 percent of the sites actually visited.

- Estimates of administrative costs attributable to O&M indicate that this is a significant fraction of the total O&M investment--often as much as ten percent and sometimes larger. Moreover, little accurate documented information exists on these administrative costs.

- "Normal" operation of wastewater facilities, i.e., plants operating for at least a year in a continuous mode at a consistent treatment level without major upset or failure and having good records of such operation, appear to be the exception rather than the rule.

- Analysis of O&M costs is hampered, especially for advanced secondary and advanced wastewater treatment plants, by the lack of adequate numbers of such facilities with a record of normal operation.

- Little difference in annual O&M costs was observed between secondary, advanced secondary, and advanced wastewater treatment facilities.

- Few wastewater treatment plants--approximately 15 percent of the total--were found to operate near their design flow. Most--74 percent--were underloaded. Seventy-seven of the 88 advanced wastewater treatment plants studied were underloaded; five were overloaded.

- Personnel costs constitute the largest component of annual O&M costs for both treatment plants (almost 50 percent of the total) and conveyance systems (60 percent of the total).

- Information on O&M staff needs for both plants and conveyance systems is inadequate. Many authorities use contractors for O&M tasks rather than employing resident staff. However, accurate records are not maintained on equivalent staff hours procured through contracts.

- Accurate O&M costs are difficult to obtain for wastewater conveyance systems, especially those in small municipalities. Many such authorities have a unified public works budget and do not keep separate records of costs for operating and maintaining their sewer system.

# 1.0 INTRODUCTION

## BACKGROUND

Effective, efficient operation and maintenance of facilities can mean the difference between success and failure in water pollution control efforts (1). Inadequately or improperly operated collection and treatment works--no mater how well designed, sited, or constructed--are unlikely to produce desired results. But O&M is not inexpensive; it is often a significant portion of the total costs of wastewater collection and treatment. In fact, it has been reported that more will be expended for O&M over the lifetime of most facilities than initially invested in capital costs (2). It is essential then that O&M costs be carefully considered as the facility is being planned to assure adequate funding for these purposes once it is constructed.

Despite the efforts of EPA's Construction Grants Program to insure that O&M costs are given full consideration during facilities planning, following construction many facilities often are allotted prohibitively small O&M budgets by their owner authorities. There are two aspects of this problem. One is the human proclivity for being more concerned with today's costs than with tommorrow's. The other is that realistic estimates of such costs are extremely difficult to obtain because of the inadequacy of data linking O&M costs to the size and/or efficiency of operation of various facilities. Improved information on O&M costs can help mitigate both aspects of this problem.

Recognizing this, EPA initiated efforts in 1976 to collect and analyze information on O&M costs for municipal wastewater treatment and conveyance systems. Cost data on selected facilities were systematically obtained for the period from late 1972 to early 1977 and presented in a 1978 report (2). Until now this report has been the only general tool available for estimating probable O&M costs for future systems.

Rapid changes in parameters affecting costs--inflation and interest rates, energy, chemical, and labor costs, to name a few--make it necessary to update and expand O&M cost information periodically. For this reason EPA entered into a contract in 1979 to obtain additional data on specific kinds and sizes of municipal wastewater control facilities, to update the data obtained earlier, and to re-analyze all of this information to produce more current, comprehensive estimates of annual O&M costs. This report presents the results of that effort.

As used here the term "O&M costs" refers to those expenditures related to daily operation and maintenance of a wastewater treatment plant or conveyance system. Specifically not included in this definition are replacement costs beyond routine repair and/or replacement of equipment, and the costs for debt service and/or amortization.

## PURPOSE

To be eligible for funding under the Construction Grants Program, each proposed wastewater control facility must undergo a cost effectiveness analysis. An integral part of this analysis is the examination of projected O&M costs and the determination that such projections are reasonable and appropriate.

The purpose of the effort being reported here is to provide EPA with improved information on which to base such funding decisions. Specifically, the effort was designed to provide for the continuation, enhancement, and, as appropriate, redirection of O&M cost estimating acitivities that have been carried out by EPA since 1976.

## OBJECTIVES

Specific objectives adopted in support of this overall purpose include:

- Collection of O&M information on certain specific sizes and kinds of facilities.
- Development of consistent, uniform O&M data for such facilities representative of the U.S. at large.
- Preparation of these data for inclusion into the automatic data processing files of EPA.
- Examination of the effect of geographical distribution on these data.
- Presentation of these data in terms of their more significant components.
- Analysis of the data base to investigate possible relationships between O&M costs and certain accepted parameters of facility size, type, and efficiency.
- Recommendations regarding the need for additional study or research on O&M costs.

## APPROACH

Operation and maintenance data contained in a 1978 EPA report (2) served as the starting point for the present effort. This data base consisted of information on more than 300 individual wastewater treatment plants and more than 150 sewer systems across the U.S. These data, and information from other rports in the technical literature, were reviewed to determine their usefulness for the current study. Part of this information was used in preparing this report.

The criteria used in making this selection included data reliability, geographical distribution, and type of treatment system. These same criteria were used to select additional plants and facilities for study during the present effort.

The 1978 Needs Survey provided a listing of the number of municipally owned treatment plants and collection systems in existence and potentially available for inclusion in the study (3). Preliminary decisions were made about facilities to be visited. EPA Regional and State agency people were asked for advice about the suitability of such facilities for this purpose. Contact was made with personnel responsible for those treatment works which seemed to present the opportunity for successful data collection efforts. The results of this contact served as the final test of which plants and facilities would be visited.

Data on the facility and its operation and maintenance costs were obtained from the selected sites. These raw cost data were updated to a common dollar base using approved indexes and standard updating techniques. Then the data were subjected to bivariate analysis to investigate the possibility of predictable relationships between O&M costs and certain standard parameters of facility size, function, or efficiency. The results of such analyses were reduced to statistical parameters, mathematical relationships, and graphical plots which are presented and discussed in the body of this report.

## SCOPE

Data for this study were obtained from 916 treatment facilities and 482 conveyance systems located in 41 of the 48 contiguous United States.

These data represent costs incurred during the period 1973 to 1981. Only facilities with secondary or higher levels of treatment receiving wastes from separate sewer systems were selected for this effort. All lagoon systems were excluded, as were systems with combined sewers. A further requirement for inclusion in this study was a recent, full year of records for normal operating conditions.

Data analyses were performed for three levels of treatment, three levels of performance as measured by plant loading and by pollutant removal, and for different levels of plant complexity.

Illustrative examples are presented at several points in this report for guidance in the use of the data and results of the study.

# 2.0 DEFINITIONS AND PROCEDURES

## INTRODUCTION

This effort followed and took direction from an earlier and similar effort by EPA to obtain and present information on O&M costs for municipal wastewater control facilities (2). The present study addressed objectives and dealt with questions not convered before. It required the collection, analyses, and presentation of new information on certain types of facilities, and the integration of this information with previously published data on similar systems. Thus, decisions were required as to definition of terms; type, location, and number of facilities to be investigated; type, precision, and accuracy of the information to be obtained from each facility; procedures for data handling and analysis; and the manner of data presentation and discussion.

This section gives the basic definitions used in this study. It also describes the procedures employed in this effort: how the facilities were selected for study, how the data were collected, and how the data were analyzed and presented. This description is meant to provide a general overview of the investigation. Specific points of procedure and methodology are discussed, as appropriate, in subsequent sections of this report.

## DEFINITION OF TERMS

Following is a listing of terms frequently used in this report, arranged alphabetically according to functional groups of definitions. Many of these terms have a variety of definitions and interpretations within the sanitary engineering community; however, the definitions given below are applied consistently and uniformly throughout this report. The definitions apply to this report only and are not necessarily the same as used in other times and places by EPA or by others involved with water pollution control.

### ABC Classification

The Association of Boards of Certification for Operating Personnel in Water and Wastewater Utilities (ABC) classification system is a method for determining the relative complexity of treatment facilities. The system assigns points to treatment plants based on numerous factors such as population served, receiving stream sensitivity, variation in loading, treatment processes in use, and laboratory testing methods utilized. These points are then summed to indicate a complexity of operation relative to other facilities.

### Collection Systems

Collection systems are defined in this report as the agglomerate of gravity collector sewers, interceptors, lift stations, and associated force mains necessary to collect and transport municipal and industrial wastewater to a treatment facility. Systems transporting stormwater in any appreciable extent were excluded from this study.

Combined Sewer System. A combined sewer system is one which carries stormwaters in addition to sanitary and/or industrial wastewater.

Separate Sewer System. A separate sewer system, or sanitary sewer, is a system intended to carry only sanitary and/or industrial wastewater from residences, commercial buildings, industrial plants, and institutions.

## Cost Information

All cost information given in this report is expressed as 1st Quarter 1981 dollars unless specifically noted otherwise. Several types of costs are discussed as follows.

Administrative Costs. Costs for administrative and support activities related to the daily operation and maintenance of the wastewater control facility are defined as administrative costs. These costs are associated with functions such as supervising a central office, purchasing, billing and other financial activities, legal assistance, and clerical duties. In this report administrative costs are not included in the total operation and maintenance costs but are presented separately.

Component Costs. Component costs are general budgetary categories which collectively make up the total O&M costs. Several components, itemized below, are analyzed in this report.

- Personnel - This component includes wages and fringe benefits.
- Utilities - All expenditures for electrical power, natural gas, telephone, fuel, and water are included in this component.
- Chemicals - This component includes costs for all process chemicals including disinfectants, coagulants, and sludge conditioners. Laboratory chemicals are considered supplies as a part of the equipment and materials component.
- Equipment and Materials - Expenditures for minor machinery, routine replacement of parts, laboratory equipment and supplies, tools, and routinely consumable supplies are part of this component. The supplies included are for process, building, grounds and vehicle maintenance, laboratory work, and office management.

- Contractual Services and Other - This component includes any contracted function and costs which are not accounted for in other components. Examples of services which are often contracted are sludge handling, sludge disposal, laboratory work, contract maintenance, and engineering consultation. Some items in the "Other" category are travel, transportation, training, vehicle and equipment insurance, and magazine subscriptions.

- Replacement Costs. Replacement costs are the costs for replacing or repairing major equipment items or for the replacement, reconstruction, expansion, upgrading, or betterment of the entire facility. They represent the decline in worth of operating assets because of day-to-day consumption in providing services. They are not included in the total operation and maintenance costs presented in this report.

- Sludge Handling Costs. Sludge handling costs represent that portion of the total plant expenditures necessary for sludge treatment process O&M and ultimate sludge disposal. Sludge handling costs, both on-site and contracted sludge treatment and disposal costs, are included in total operation and maintenance costs in this report.

- Total Operation and Maintenance Costs. All expenditures for the daily operation and maintenance of a wastewater treatment plant or sewer system are termed total operation and maintenance costs. Components which make up total O&M costs include personnel, utilities, chemicals, equipment and materials--including the cost of minor equipment repair and replacement--and contracted services. Sludge treatment and disposal costs and laboratory costs are also part of the total operation and maintenance costs, regardless of whether they are on-site activities or contracted. Specifically not included are administrative costs, replacement costs beyond routine repair and/or replacement of equipment, and the costs for debt service and/or amortization.

## Hydraulic Loading

Design Loaded. Treatment facilities with average annual hydraulic loadings in the range of 90 to 110 percent of design flow are referred to as design loaded.

Overloaded. Treatment facilities with average annual hydraulic loadings greater than 110 percent of the design flow are defined as overloaded.

Underloaded. Treatment facilities with average annual hydraulic loadings of less than 90 percent of design flow are defined as underloaded.

## Sludge Handling

Complex Sludge Handling. Complex sludge handling is a term used to categorize those treatment facilities where the sludge treatment scheme includes at least one of the following processes: heat treatment, wet air oxidation, incineration, or pyrolysis.

Moderate Sludge Handling. Moderate sludge handling is a term used to categorize those treatment facilities where the sludge treatment scheme includes dewatering (centrifuge, vacuum filter, or filter press), but excludes more complex processes such as heat treatment, wet air oxidation, incineration, or pyrolysis.

Simple Sludge Handling. A simple sludge handling scheme includes, as its most sophisticated process, one of the following unit processes: aerobic digestion, anaerobic digestion, sludge lagooning, composting, gravity thickening, or sludge flotation.

## Staff Size

Staff size represents equivalent full time staff utilized for operation and maintenance of the treatment facility or sewer system. Equivalent full time staff is based on a 40 hour work week and is calculated from reported average weekly staff hours at the facility.

## Treatment Levels

Secondary Treatment. Secondary treatment facilities are defined as those facilities, regardless of treatment process, designed to reduce the five day Biochemical Oxygen Demand (BOD) effluent concentration to between 25 and 30 mg/l, inclusive. No data were collected from lagoon systems or other so-called secondary facilities having design effluents greater than 30 mg/l.

Advanced Secondary Treatment. Advanced secondary treatment (AST) facilities are defined as those facilities designed to reduce the five day BOD effluent concentration to a value in the range of 11 to 24 mg/l, inclusive. This definition makes no distinction between types of treatment processes or whether or not there is any requirement for nutrient removal.

Advanced Wastewater Treatment. The advanced wastewater treatment (AWT) category includes facilities designed to reduce the five day BOD effluent concentration to 10 mg/l or less, without regard to nutrient removal.

## Treatment System Type

Attached Growth Systems. Attached growth systems are those whose liquid treatment scheme includes trickling filters and/or rotating biological contactors.

Suspended Growth Systems. Suspended growth systems are those whose liquid treatment scheme utilizes some form of activated sludge process including extended aeration, oxidation ditch systems, and pure oxygen.

## DATA COLLECTION PROCEDURES

Generation of a comprehensive, statistically valid base on total annual O&M costs and staffing requirements for wastewater control facilities was a major objective of this project. A further concern was that this data base provide consistent, uniform information representative of the entire U.S. and permit delineation of the variations in costs and staffing between geographical areas. Thus, the initial step in the process was the judicious selection of facilities from which to collect the needed data.

The selection was accomplished through repeated screenings of the 1978 Needs Survey (3) and through questioning of knowledgeable persons in EPA's Regional offices and in State water quality control offices. Final selection was based on actual questioning of personnel from prospective facilities.

An initial decision was to limit the effort to treatment systems producing secondary or higher levels of treatment which are served by collection systems that carry municipal and industrial wastes only. Collection systems carrying stormwater were ruled out, as were lagoon type treatment systems regardless of their performance level.

The decision to link collection systems to treatment facilities in the data gathering efforts was based on the assumption that communities with good cost records for treatment plants likely would maintain good records on their sewer systems--an assumption that proved to be untrue in many cases.

Following these decisions, the 1978 Needs Survey was examined to determine the number of treatment plants and conveyance systems in existence and potentially available for inclusion in the data base. Decisions were then made regarding the total number of facilities needed for the data base and their distribution with respect to EPA Regions. It was decided to select a certain minimum number of plants of each performance level (secondary, advanced secondary, and advanced wastewater treatment) and of each hydraulic loading condition (underloaded, design loaded, and overloaded) for each Region.

Information on plants and facilities contained in the 1978 report, Analysis of Operation & Maintenance Costs for Municipal Costs for Municipal Wastewater Treatment Systems, MCD-39 (2) was screened to determine the availability of necessary data from this source. This led to a determination of the number of additional data sources needed in each Region. The final facility selection criteria are listed below.

Secondary Treatment: A base of 50 plants per Region was required. At least 30 new plant visits were made in each Region with approximately 30 additional visits for those Regions with more than 600 secondary facilities.

Advanced Secondary Treatment: A base of 15 plants per Region was included in the combined data base. At least ten new plant visits were made in each Region.

Advanced Wastewater Treatment: A slightly different approach was used to create the sample for AWT facilities. For those Regions with less than 100 such facilities, a base of seven plants per Region was included in the combined data base. Regions having 100 to 300 AWT facilities provided ten plants per Region, while 12 plants each were selected in those Regions with more than 300 AWT facilities.

Following the determination of the number of facilities needed for the study in each Region, the 1978 Needs Survey again was consulted in order to select specific facilities capable of meeting the following criteria:

- Representing the full range of treatment levels (secondary to AWT).
- Being served by separate sewers.
- Representing the full range of hydraulic loading (underloaded, design loaded, and overloaded).

Additional criteria were introduced at this point. Facilities selected were required to have at least one full year of "normal" operation and a history of good recordkeeping. Normal was defined as continuous operation at a consistent treatment level. These criteria were utilized to eliminate facilities which had experienced recent major plant upset or failure, natural disaster, expansion, and/or upgrading.

Representatives of Regional EPA offices and State water pollution control regulatory agencies, using their knowledge of specific plant operating characteristics, assisted in selecting the proposed list of plants to be visited in each State. Each proposed facility was contacted. Information about the project was provided, the need for a site visit was explained, and cooperation was solicited. This contact was the final step in selecting facilities for this study. If the facility did indeed meet all the criteria and if the owner/operator appeared cooperative, the facility was chosen.

Contractor personnel visited most of the sites and collected information on total annual O&M costs, staffing, performance, and other facility characteristics. Data for a few of the sites were obtained by telephone or written requests. A summary of the data items collected is presented in Table 2.1 and Table 2.2 for the treatment plants and sewer systems, respectively.

## TABLE 2.1

## SUMMARY OF TREATMENT PLANT INFORMATION ITEMS

Facility Identification: Facility name, name of operating authority, City or town, county, State, zip code, EPA Region, authority/facility number (from the Needs Survey), facility architectural/engineering firm, and service population.

Information Dates: The month, day, and year defining the end of the fiscal year from which were taken actual or budgeted costs and operating information. Also, the year in which the last major modification was completed.

Permit Information: The National Pollution Discharge Elimination System (NPDES) number, and maximum values based on a 30 day average for influent flow (mgd) and effluent concentrations (mg/l) of BOD, Suspended Solids (SS), and any applicable nutrient.

Wastewater Characteristics: Actual average daily concentrations (mg/l) of BOD, SS, and any applicable nutrient in influent and effluent; actual average daily flow (mgd); peak daily flow (mgd) for the year being reviewed; and average daily industrial flow (mgd).

Facility Design Parameters: Influent and effluent average daily concentrations (mg/l) of BOD, SS, and any applicable nutrient for which facility was designed.

Staffing Information: Number of employees at facility, average number of hours per week for superintendents, supervisors, operators, maintenance staff, chemists, laboratory technicians, laborers, and others. Also, percentage of overall hours devoted to supervision, upkeep, liquid line, and sludge line.

Cost Information: Total annual O&M costs, either budgeted or actual, in terms of power, total utilities, personnel, chlorine, total chemicals, equipment, materials, contractual and other, and administrative costs (for offsite facility management). When possible, costs associated strictly with sludge handling and laboratory work were segregated.

Yearly totals for replacement/capital improvement costs for major facility work were retrieved. These costs were not reflective of plant expansion, nor for any work not fully financed by the operating authority. Several years' information was collected.

General Facility Information: Type of sewer system serving the plant, i.e., sewers carrying domestic/industrial flow only, or sewers carrying combined domestic/industrial and stormwater flows.

Treatment level, i.e., design effluent concentrations (mg/l) for BOD and any applicable nutrient.

TABLE 2.1 (Concluded)

Percentage value of average daily flow attributed to infiltration/inflow (I/I) and comment if I/I presented a problem.

Unit processes in operation at facility (i.e., bar screen, primary clarification, chlorination).

Daily amount of dry solids (lbs./day) removed from the facility.

Plant classification based on the ABC method.

## TABLE 2.2

## SUMMARY OF SEWER SYSTEM INFORMATION ITEMS

Total miles of gravity sewer pipe in the system and diameter range (inches) of the pipe.

Total miles of force main in the system and diameter range (inches) of the pipe.

Number of lift stations in operation in the system, the design pumping capacity (mgd) of each, and the motor horsepower of each.

Number of service connections to the collection system.

Number of collection system employees and average hours per week in areas of supervision, foreman, maintenance, equipment operation, laborer, and other.

Total annual O&M costs, either budgeted or actual, in terms of personnel, power, equipment and materials, contractual and other, and administrative costs (for administration and management of collection system).

Yearly totals of replacement/capital improvement costs for the collection system. These costs were not reflective of system expansion, nor for any work not fully financed by the operating authority. Several years' information was collected.

Records of actual expenditures were the prime source of cost information. Where actual cost records were not available, budget information from the last complete fiscal year of operation or estimates by the facility personnel were utilized.

While in the field, project personnel recorded the required information on specially designed forms. A manual quality assurance check was made of these forms prior to entering the data into the computerized data file. After data entry, every data item was screened by computer to verify that it fell within a prescribed range of values. Any data item not passing the computer screen was examined manually by inspection of the data collection form and the written record of the site visit. Data items which remained outside of the prescribed range of values after this review were checked further with the respective municipal operating personnel. Only data items passing these screenings were retained in the data base.

Data collected for this study were added to EPA's existing O&M data base. The combined data base represents costs from 41 States and all ten EPA Regions. Table 2.3 shows the distribution of plants and sewer systems for which data were obtained. Some 100,000 data items from 916 treatment facilities and 482 sewer systems are contained in the data base. Because of various necessary exclusions and screenings, only 723 treatment facilities and 419 sewer systems were used in the analyses presented here.

## COST UPDATING PROCEDURES

Cost data collected during this study were for the period from 1972 to 1981. To enable comparable analyses, these costs were updated to 1st Quarter 1981.

The EPA developed Quarterly Indexes of Direct Cost for Operation, Maintenance and Repair (OM&R)[1] were used to update the raw cost data. These indexes are prepared quarterly by the Facility Requirements Division of EPA to reflect changes in O&M costs for wastewater treatment facilities and conveyance systems. The base year for the Treatment Facilities Index is 1967; for the Conveyance System Index, 1973. The indexes were published annually from 1967 to 1973 and on a quarterly basis thereafter.

### Updating Wastewater Treatment Facility Costs

The EPA developed OM&R Indexes for treatment plants are based on categorical cost estimates for operating and maintaining a 5.0 mgd activated

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[1] Although EPA uses this terminology for these indexes, a more common definition of OM&R is Operation, Maintenance and Replacement which, in general, is the context in which O&M is used in this report.

## TABLE 2.3

## DISTRIBUTION OF PLANTS AND SEWERS BY EPA REGION AND LEVEL OF TREATMENT

| | Secondary Plants | | AST Plants | | AWT Plants | | Sewer Systems | |
|---|---|---|---|---|---|---|---|---|
| EPA Region | Number Available* | Number in Data Base** | Number Available* | Number in Data Base** | Number Available* | Number in Data Base** | Number Available* | Number in Data Base** |
| 01 | 282 | 21 | 32 | 5 | 7 | 3 | 549 | 21 |
| 02 | 306 | 63 | 146 | 17 | 15 | 12 | 1,049 | 38 |
| 03 | 471 | 32 | 313 | 28 | 103 | 12 | 2,445 | 36 |
| 04 | 1,736 | 54 | 182 | 32 | 118 | 16 | 3,765 | 59 |
| 05 | 1,172 | 55 | 859 | 20 | 318 | 7 | 3,764 | 63 |
| 06 | 554 | 42 | 450 | 49 | 22 | 10 | 3,123 | 47 |
| 07 | 874 | 53 | 7 | 14 | 2 | 8 | 2,959 | 41 |
| 08 | 613 | 51 | 30 | 12 | 17 | 6 | 1,450 | 47 |
| 09 | 271 | 26 | 46 | 20 | 26 | 8 | 1,207 | 36 |
| 10 | 243 | 22 | 85 | 18 | 12 | 7 | 828 | 31 |
| TOTALS | 6,522 | 419 | 2,150 | 215 | 640 | 89 | 21,139 | 419 |

* Source: 1978 Needs Survey (3) for number of existing facilities.

** The number of facilities included in the data base includes those investigated under this contract, as well as those investigated and reported under an earlier contract.(2).

sludge facility. Eleven O&M cost categories are considered including labor, power, utilities, chemicals, and administration. A composite index was developed from the categorical indexes to form an average O&M Escalation Index.

In collecting data for this report, total O&M costs for wastewater treatment facilities were separated into several components. Table 2.4 lists these components and presents the indexes applied to update each of them.

### Updating Wastewater Conveyance Systems Costs

The EPA developed OM&R Indexes for updating wastewater conveyance O&M costs use separate indexes for gravity sewers and for those having lift stations. The Lift Station Index is based on a national average cost for the operation, maintenance, and repair of a 1.0 mgd average flow rate raw wastewater lift station. The Gravity Sewer Index is based on a national average cost per mile for the operation, maintenance, and repair of municipal sewer lines excluding the cost of lift stations. Table 2.5 outlines the appropriate indexes applied to update the specific cost components for sewer systems.

### Cost Updating Formula

Raw data were updated to 1st Quarter 1981 dollars using the following formula:

$$\begin{array}{c}\text{O\&M Item Specific Cost}\\ \text{from Data Base as}\\ \text{Collected}\end{array} \times \frac{\begin{array}{c}\text{EPA O\&M Item Specific}\\ \text{Cost Index (1st Qtr 1981)}\end{array}}{\begin{array}{c}\text{Appropriate Qtr EPA O\&M}\\ \text{Item Specific Cost Index}\end{array}} = \begin{array}{c}\text{O\&M Item Specific}\\ \text{Cost 1st Qtr 1981}\end{array}$$

## DATA ANALYSIS AND PRESENTATION

Most data analysis for this report took the familiar form of using one parameter as the sole predictor of a second parameter. The method employed was bivariate analysis using a linear regression technique; a convenient, widely accepted way of analyzing both large and small data sets for relationships.

The least-squares method was used for the linear regression analysis. This method yields a linear regression equation--expressing one variable in terms of another--and certain kinds of statistical information about this equation and the relationship it expresses.

The large sample sizes encountered in this study precluded, in most cases, the display or presentation of individual data points. Because of this, a general rule was adopted that no data points be used in the graphical presentations. Rather the information usually is presented as

## TABLE 2.4

## WASTEWATER TREATMENT FACILITY O&M COST UPDATING INDEXES

| Cost Category from Data Base | EPA Developed OM&R Index Used for Update* |
|---|---|
| Total O&M Costs | Total of All Cost Categories or Average OM&R Escalation Index if only Total Costs Available |
| Personnel | Labor Index |
| Power | Power Index |
| Total Utilities | Power Index |
| Chlorine | Chlorine Index |
| Total Chemicals | Overall Chemical Index |
| Equipment | Maintenance Index |
| Materials | Wholesale Price Index for Industrial Commodities |
| Contractual | Labor Index |
| Other | Other Costs Index |
| Replacement Items | Maintenance Index |
| Administrative | Administration Index |

* Available through the Priorities & Needs Assessment Branch, Facility Requirements Division, U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D. C. 20460.

## TABLE 2.5

## WASTEWATER CONVEYANCE SYSTEM O&M COST UPDATING INDEXES

| Cost Category from Data Base | EPA Developed OM&R Index Used for Update* |
|---|---|
| Total O&M Costs (Sewer Systems without Lift Stations) | Total of All Cost Categories or Average Sewer OM&R Index without Lift Stations |
| Total O&M Costs (Sewer Systems with Lift Stations) | Total of All Cost Categories or Average Sewer OM&R Index with Lift Stations |
| Personnel | Labor Index |
| Power | Power Index |
| Equipment and Materials | Equal Weighted Composite of Subindexes for Cleaning, Testing, and Maintenance of Sewer Lines |
| Contractual | Labor Index |
| Other | Composite of Subindexes |

* Available through the Priorities & Needs Assessment Branch, Facility Requirements Division, U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D. C. 20460.

the log-log plot of the linear regression equation together with appropriate statistical information about the data used. Some information is presented in tabular form. Unless otherwise indicated, the data are presented in 1st Quarter 1981 dollars and are representative of the entire nationwide data set for the particular system or systems being discussed.

Further explanation of this approach is provided in subsequent sections of this report, together with examples of the use and interpretation of the information presented.

# 3.0 FINDINGS

## INTRODUCTION

This chapter presents the most current, comprehensive information available on annual O&M costs for municipal wastewater control systems. Total O&M costs reflecting the general national situation were obtained by collecting appropriate data from throughout the U.S. In the case of secondary treatment facilities, information descriptive of conditions in each of the ten EPA Regions was segregated from the larger data base and is presented separately. Data on administrative costs, sludge handling costs, staffing and personnel costs, power costs, and lift station costs associated with municipal sewerage works also are presented. Where appropriate, total O&M costs are reduced to their principal components, i.e., personnel, utilities, chemicals, materials and equipment, contractual and other.

Costs presented are those annual costs required to maintain design capacity and performance over the life of the facility. They include only those replacement costs which apply to the routine replacement of minor equipment, accessories, and appurtenances. They do not include costs for replacement of major equipment items or of entire facilities. Neither do they include costs for debt service or amortization.

All costs are presented in 1st Quarter 1981 dollars and are reported and compared on the basis of such system variables as design flow, actual flow, degree and method of treatment, method of sludge handling, population served, and length of collection system.

The data reported here were collected and analyzed by commonly accepted techniques. However, certain limitations relative to both data collection and analyses should be recognized before attempting to apply these results to specific cases. These data generally reflect well operated plants and systems, functioning under normal conditions, and having good operating records. Nevertheless, some O&M component cost data were not available for some of the sites visited. Complete cost data were available for only about 60 percent of the sites with data from the remaining facilities consisting of a combination of actual and budgeted or estimated costs. In addition, the data have not been normalized to account for cost differences inherent to various parts of the country, such as might be found among identical plants treating identical wastewater, but located in different geographical areas.

The method of data analysis used in this report--bivariate analysis using linear regression--is widely accepted in the sanitary engineering community as a way of analyzing and expressing data. However, in interpreting the results of such analysis, it is important to keep in mind certain aspects of the method. For example, the technique always yields an equation--the regression equation--which can be plotted as a straight line--the regression line--on log-log paper, regardless of the true relationship between one parameter and the other. Thus, strong relationships between parameters often are assumed, even when they do not exist, because of the equation or graph generated. This can result in the placing of more confidence in the relationship expressed by the graph or equation than is merited.

The bivariate, linear regression approach was used because it is both a convenient means of expressing large numbers of data points and a useful analytical tool. In this report large sample sizes preclude display of individual data points in many cases, thus it was decided not to plot individual data points on any of the graphs. Rather, the data were used to develop the regression equation which was then plotted to illustrate general trends. For this reason statistical information is included with each graph to help in defining the significance of the relationship.

In general, large sample sizes (n) and high values of the squared correlation coefficient ($r^2$) imply more statistically sound relationships. To provide an indication of data scatter, most of the graphs--regardless of the associated number of data points--include a shaded band about the plotted regression line. The shaded region is an indication of data scatter--the "goodness of fit" of the data points to the plotted line. The wider the bands the greater the degree of scatter in observed data and the less reliable the equation of the plotted line as a measure of the true relationship(s) between one variable and the other. Examples are used to illustrate the application of these graphs.

Despite such limitations this report represents the most comprehensive information currently available on the O&M costs of U.S. water pollution control systems. Used with good engineering judgment and normal engineering estimating procedures, it should be helpful in providing more definitive preliminary estimates of O&M costs for several kinds of wastewater control processes and facilities.

## TREATMENT PLANTS

### Administrative Costs

Cost for administrative and support activities related to the daily operation and maintenance of wastewater control facilities are defined here as administrative costs. Such costs might include those for supervising a central office, purchasing, financial management, legal assistance, general computer usage, and routine clerical support. These services often are provided at locations separate from the wastewater control facility and by an authority of which the wastewater system is but one subunit. This study found that such authorities seldom maintain records sufficient for segregating administrative costs for each of its subunits. Because of this, much of the information collected on administrative costs is an approximation obtained at the site, according to "best available estimates," but likely having less reliability than the data on other O&M cost components. For this reason, it was decided to exclude administrative costs from other O&M costs in this report and to present the available administrative cost information separately.

Administrative cost data were collected for secondary, advanced secondary, and advanced wastewater treatment plants. These data were analyzed to examine their relationships to design flow, and the three regression lines resulting from the analyses are shown in Figure 3.1.

It should be noted that these are administrative costs associated with the plants only. Insufficient information was collected to permit a meaningful analysis of sewer system administrative costs. Figure 3.1 represents data from 385 plants from all Regions of the contiguous United States. The number (n) of each type facility is shown on the figure and in each case is sufficiently large to assure reliability of the information.

The regression lines--or the regression equations--of Figure 3.1 show that, as expected, administrative costs generally increase as design flow ($Q_D$) increases. However, caution must be used in interpreting the information presented here. First, it should be noted that the square of the correlation coefficient ($r^2$) is low in all three cases. An $r^2$ of 1.0 would indicate a perfect fit between the data and the regression line, i.e., all the real data actually fall on the line. Thus, the lower values of $r^2$ contained in Figure 3.1--0.357, 0.282, and 0.382, respectively--indicate that the relationships between administrative costs and design flow depicted by the regression line plots are questionable. This is logical as there is a "fixed" nature to many of the components of administrative costs and the relationship between such costs and design flow might more accurately be represented, on an arithmetic plot, by some kind of step function.

Statistically there is little distinguishable difference in administrative costs between the three types of systems studied. The bulk of administrative costs are probably fixed costs having little relationship to degrees of treatment. Given the nature of the data, the conclusion is that there are no measurable differences between administrative costs for the three levels of treatment investigated.

Considering the above, the administrative cost data from all three levels of treatment were analyzed as one data set. This result is shown in Figure 3.2 which can be used to estimate the administrative costs associated with either of the three treatment levels considered. However, caution is again urged in the use of this information. There is a large scatter of data about the regression line of Figure 3.2. This is illustrated by the shaded band shown on the figure, which is of a width to contain most (approximately 95 percent) of the actual data points. The regression line itself expresses the most probable location of the actual data points. However, as the shaded band becomes larger the regression line becomes less accurate as an expression of the probable location of the actual data.

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## ADMINISTRATIVE COSTS vs DESIGN FLOW
COMPARISON: TREATMENT LEVELS
SECONDARY, ADVANCED SECONDARY,
AND ADVANCED WASTEWATER TREATMENT PLANTS

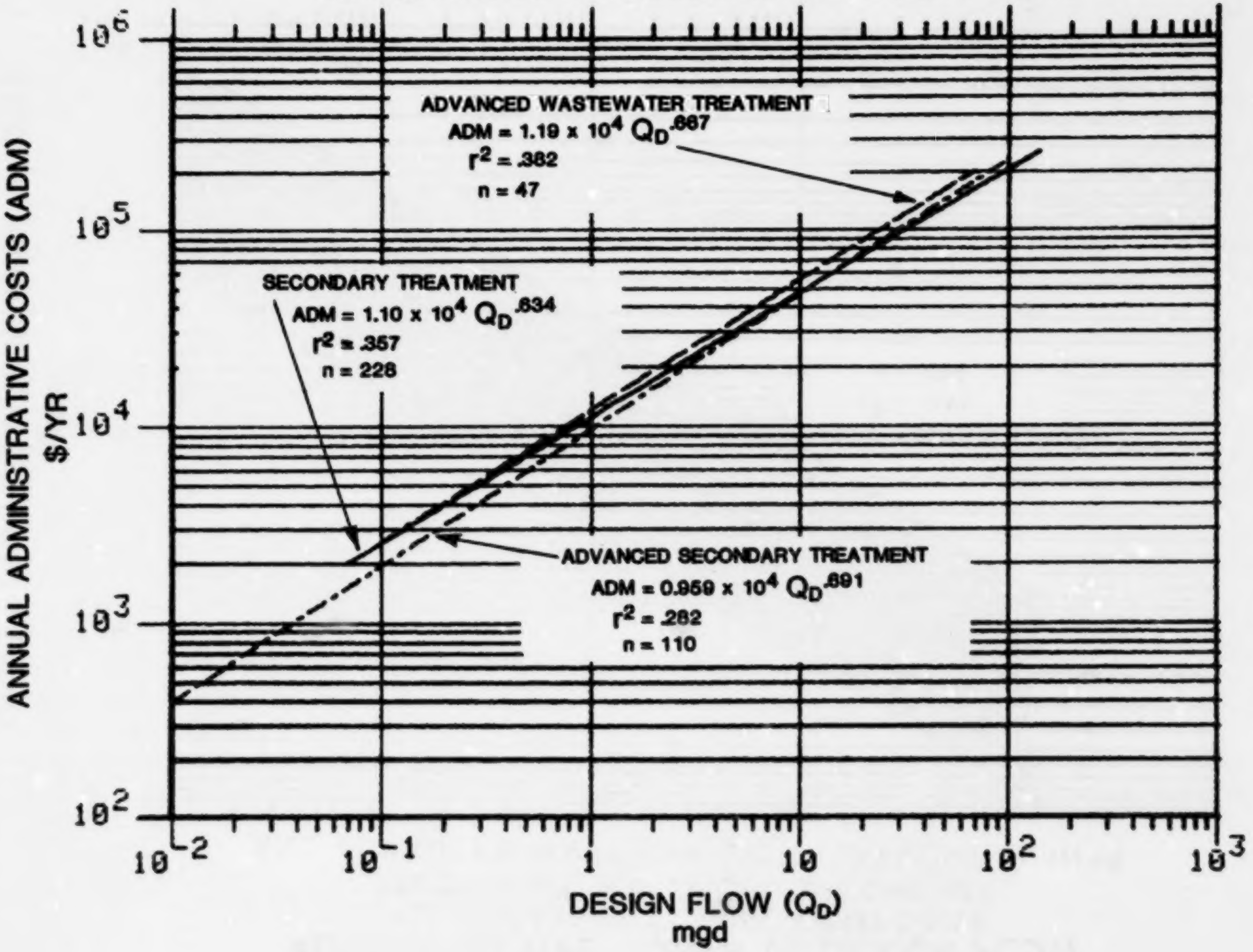

FIGURE 3.1

## ADMINISTRATIVE COSTS vs DESIGN FLOW
ALL TREATMENT LEVEL COMPOSITE
SECONDARY, ADVANCED SECONDARY,
AND ADVANCED WASTEWATER TREATMENT PLANTS

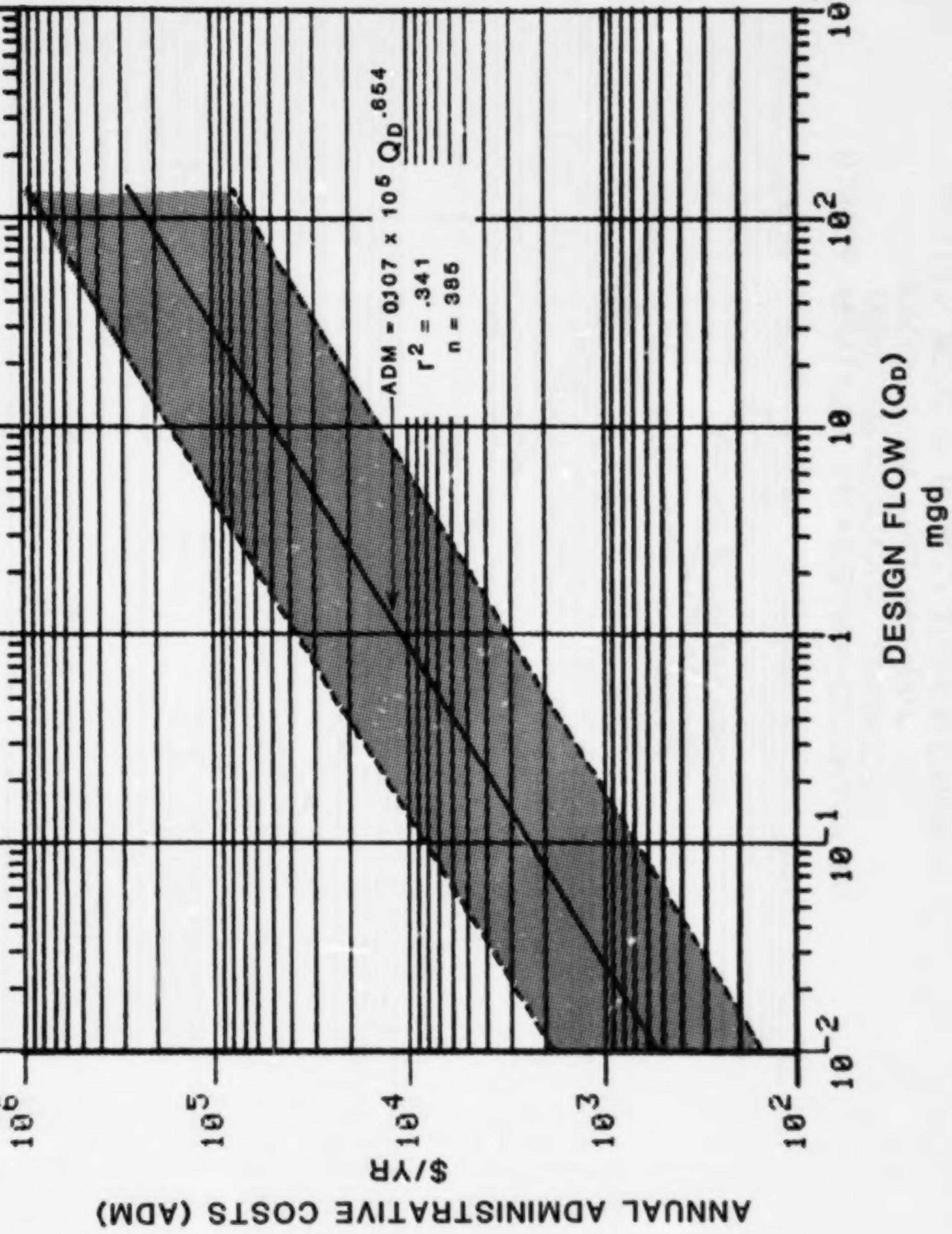

FIGURE 3.2

An example calculation based on Figure 3.2 will serve to illustrate both the use of such plots and some of the problems inherent in their use.

Example Problem: Estimate administrative costs for a secondary wastewater treatment facility having a design flow ($Q_D$) of 5.0 mgd.

Solution: From the regression line[1] of Figure 3.2 and for a $Q_D$ of 5.0 mgd, the most probable annual administrative cost is (reading from the graph at the design flow rate):

Secondary Administrative Costs = $30,000

However, the range of cost values which could be expected to contain most of the data (about 95 percent) should also be determined, and can be as follows:

From Figure 3.2, using the upper and lower boundaries of the shaded band and reading from the graph at the 5.0 mgd design flow rate, the range and the most probable values of administrative costs for the 5.0 mgd secondary facility are:

Lowest Probable Value : $ 9,000

Most Probable Value : $ 30,000

Highest Probable Value : $100,000

This tabulation shows the very large uncertainty inherent in these data which must be considered when using them. The reason for this extreme range of values for administrative costs is not clear; perhaps some plants simply spend more on such costs than others; perhaps many plants do not really know what they spend--because of poor recordkeeping or because such costs are borne elsewhere. At any rate, these data should only be used for first cut approximations of such costs.

These data also were analyzed to evaluate possible relationships between administrative costs and design flow in situations where flow is equal to or less than 1.0 mgd and greater than 1.0 mgd. It was reasoned that the general relationship between administrative costs and design flow might differ for small plants as opposed to larger ones.

The data sets for each level of treatment--secondary, advanced secondary, and advanced wastewater treatment--were used for these split analyses. In each case the results of such analyses showed that most of the plants in the data set have design flows greater than 1.0 mgd. Plants having flows equal to or less than 1.0 mgd represent only 23, 16, and 17 percent of all plants for secondary, advanced secondary, and advanced wastewater treatment plants, respectively.

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[1] This value could also be determined from the regression equation given on the figure.

The analyses of the split data sets agreed, in general, with those obtained from analyses of the total data sets. For each level of treatment, the regression equations produced from analyses of the data subsets were not significantly different from those derived using the full data sets. Neither the accuracy ($r^2$) nor the precision (shaded band width) of the regression equation as an expression of the actual data points were improved by the separate analyses. In fact, in all cases the $r^2$ was smaller for the split data--in some cases, dramatically smaller--than for the full data set. Because they revealed nothing of value, the plots of these split analyses are not included in this report.

The relative magnitude of administrative costs compared to total O&M costs for the same kinds of systems is also of significance. This calculation is shown in Table 3.1. Here, annual administrative costs are seen to be on the order of six to ten percent of annual total O&M costs. In many instances this represents a considerable sum, worthy of more careful accounting than is generally being applied at present.

## Total Annual O&M Costs

Operation and maintenance costs for the treatment systems studied--exclusive of administrative costs, major replacement costs, and debt service--are presented here. These costs are expressed in terms of plant type, size, and complexity. Information is also given on staff size for these facilities.

### Secondary Treatment Facilities:

Nationwide - More than 900 wastewater treatment plants were investigated for this study. Of these, 723 produced data of sufficient quantity and quality to permit their use in this report. Information on 376 of these--all secondary treatment facilities--is shown in Figure 3.3. The plants included here are those which produce a five day BOD effluent concentration of 25 to 30 mg/l. The plot is a generalization of the data obtained on these facilities and thus represents current, national average total annual O&M costs. The data were obtained from widely distributed geographical locations around the U.S. and the number of data entries is sufficient for good statistical generalization.

For comparative purposes, the information presented in Figure 3.3 is shown in Figure 3.4 along with plots of O&M cost information obtained from the technical literature (5, 6, 7). It was not possible to determine if the O&M costs reported in the literature include or exclude administrative costs. However, much of this information fits that obtained by this effort--most of it falling within the shaded band width (approximately 95 percent of the data) for plants with design flows ranging from 0.1 mgd to 60 mgd. In fact, the New York data (5) coincides almost precisely with the regression line from Figure 3.3 over the entire range studied. It should be noted, however, that the data on

## TABLE 3.1

## COMPARISON OF ANNUAL ADMINISTRATIVE COSTS TO ANNUAL TOTAL O&M COSTS FOR WASTEWATER TREATMENT PLANTS

| Design Flow (mgd) | Type of Facility | | |
|---|---|---|---|
| | Secondary | AST | AWT |
| 1.0 | 9% | 10% | 7% |
| 5.0 | 8% | 8% | 7% |
| 10.0 | 7% | 7% | 6% |
| 25.0 | 7% | 6% | 6% |
| 50.0 | 6% | 5% | 5% |
| 100.0 | 6% | 5% | 5% |

Note: Percentages were computed from Most Probable Values, determined by substituting the appropriate design flow value in the regression equations from Figures 3.2, 3.3, 3.17, and 3.20.

TOTAL O & M COSTS vs DESIGN FLOW
SECONDARY WASTEWATER TREATMENT PLANTS

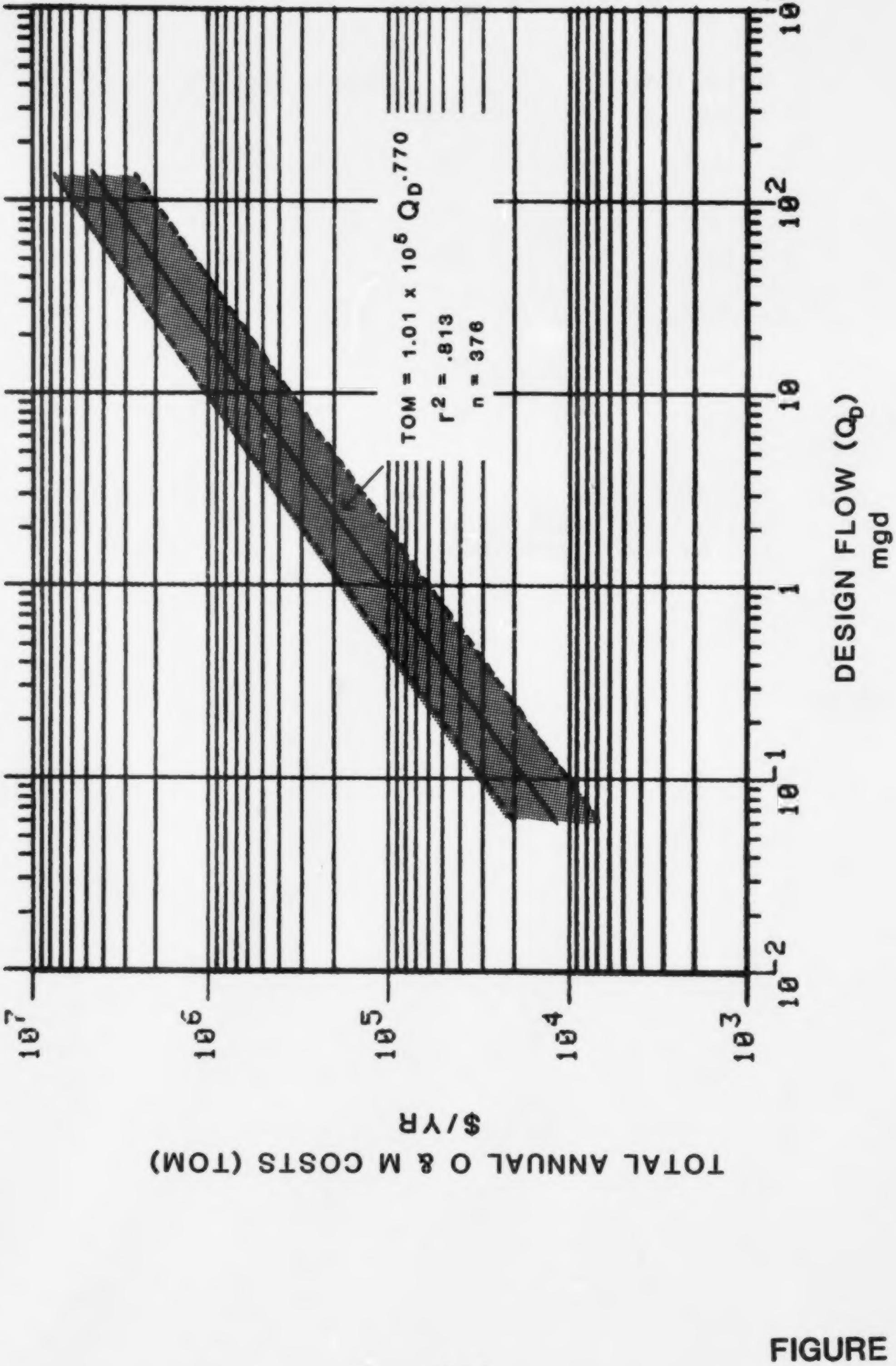
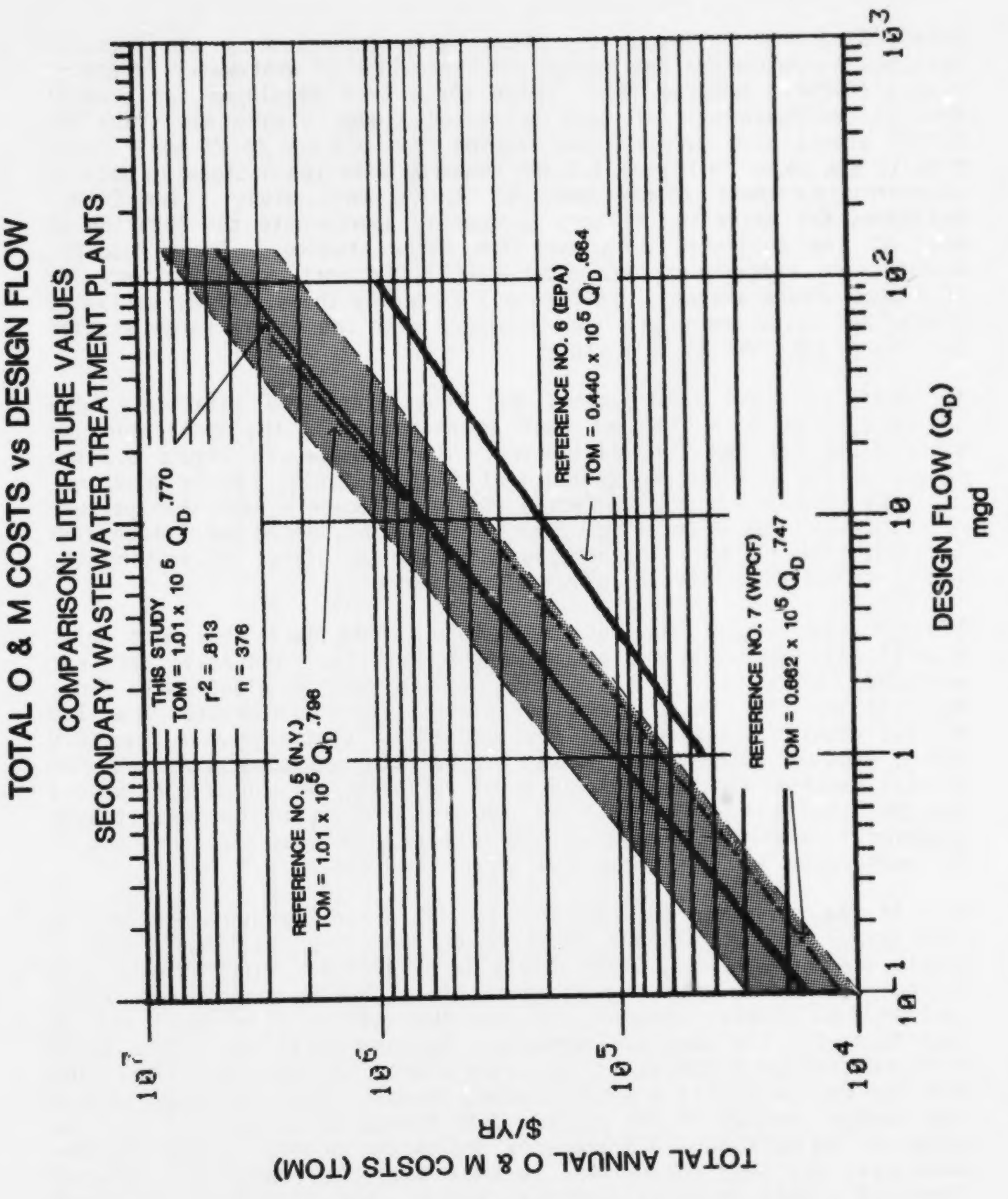


FIGURE 3.3


TOTAL O & M COSTS vs DESIGN FLOW

COMPARISON: LITERATURE VALUES

SECONDARY WASTEWATER TREATMENT PLANTS

FIGURE 3.4

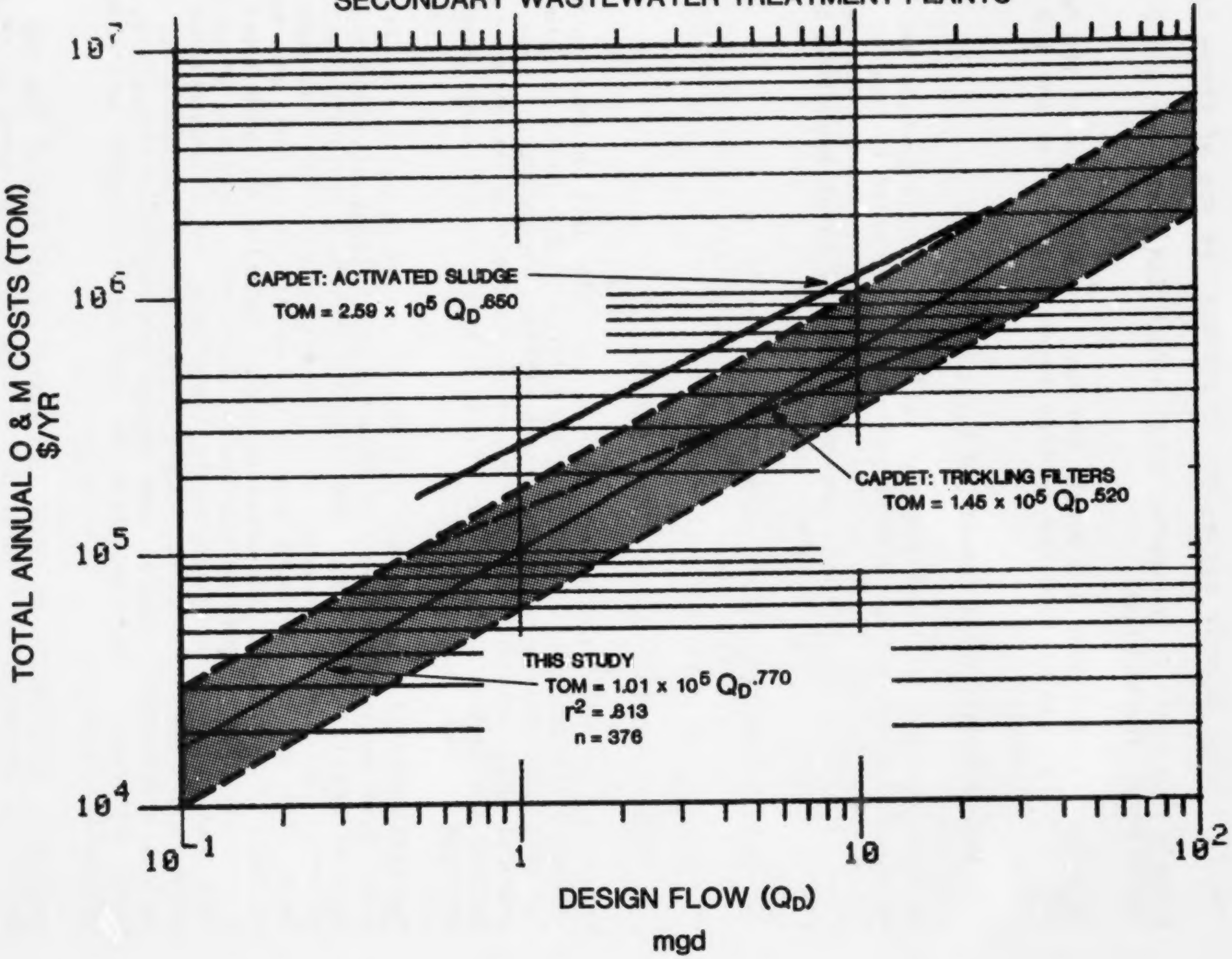
secondary plants obtained for this study show total O&M costs to be appreciably higher than those computed from the methods in an earlier EPA report (6).

Total O&M costs for secondary plants were generated by the Computer Assisted Procedure for the Design and Evaluation of Wastewater Treatment Plants (CAPDET) program (8). These costs were developed for several typical configurations of both activated sludge plants and trickling filter plants with design flows ranging from 0.5 mgd to 25 mgd. These results are shown in Figure 3.5 and compared with the nationwide data on secondary treatment plants obtained during this study. The CAPDET estimates for trickling filters adequately approximate the location of most of the collected data over the range studied. These results, however, do raise questions about CAPDET O&M cost approximations for activated sludge systems. As Figure 3.5 clearly shows, CAPDET activated sludge O&M costs are significantly higher over the entire range studied than those obtained by this study.

In light of these observations and considering the relatively wide scatter in the data, caution must be exercised in the application of these plots for O&M cost estimating. For example, on Figure 3.3 the square of the correlation coefficient ($r^2$) is 0.813; fairly good, but still far enough below a perfect 1.000 to indicate a less than perfect relationship between costs and design flow. The shaded band width also is indicative of this imperfection and can be useful in setting the limits of believability in the use of the data.

Although the results are not shown here, these data also were split several ways and each subset analyzed separately. The total data set contained information on 376 plants. There were 97 plants with flows equal to or less than 1.0 mgd, 212 plants with flows greater than 1.0 mgd but equal to or less than 10.0 mgd, and 67 plants greater than 10.0 mgd. Each of these three subsets were analyzed separately and the results compared to those for the total data set. No significant points emerged from this analysis. The regression equation for each subset compared favorably with that of the full set. But as expected, the $r^2$ for each subset was less than that in the full set.

Most of the collected data are for facilities on the lower end of the flow scale (309 of 376 are equal to or less than 10.0 mgd). There simply are not very many large plants in existence. This suggests that the bulk of the relationship shown in Figure 3.3 is contributed by the smaller facilities. However, $r^2$ for the smaller plant data set is less than for the complete secondary facility data set. This could indicate that total O&M costs vary more widely for the small facilities than for the large. It might also mean, however, that the larger plants keep better records of O&M costs. This brings up a second point. In terms of logic, Figure 3.3 compares apples and oranges. That is, the data have not been normalized to make possible comparison between identical plants treating identical wastes, but located in different



TOTAL O & M COSTS vs DESIGN FLOW
COMPARISON: CAPDET VALUES
SECONDARY WASTEWATER TREATMENT PLANTS

FIGURE 3.5

parts of the country. Thus, the observation made above regarding possible differences between large and small plants might arise from unspecified geographical differences.

The following example serves to illustrate the use of these data.

Example Problem: To determine total annual O&M costs for a 5.0 mgd secondary treatment plant.

Solution: From Figure 3.3 obtain the most probable value of the total O&M cost by reading from the plotted regression line at the 5.0 mgd design flow rate.

Most Probable Total Annual O&M Costs = $350,000

An expected range of total O&M cost values which would contain approximately 95 percent of all observed values is determined by reading from the upper and lower limits of the shaded band for the 5.0 mgd design flow. The range and the most probable values of total annual O&M costs for a 5.0 mgd secondary treatment plant are:

| | |
|---|---|
| Lowest Probable Value : | $200,000 |
| Most Probable Value : | $350,000 |
| Highest Probable Value: | $600,000 |

Figure 3.6 presents nationwide total annual O&M data on two types of secondary treatment in combination with three sludge handling methods. For this presentation suspended growth systems, regardless of type, are compared with attached growth systems, regardless of stage or type. Systems are further distinguished by the complexity of sludge handling employed as shown in Table 3.2.

The difficulty of generalizing from these data is emphasized by Figure 3.6. Over most of the design flow range studied, attached growth systems require less total O&M expenditures than suspended growth systems. This is in agreement with the estimate of O&M costs made by CAPDET for activated sludge and trickling filter systems and shown earlier. Furthermore, O&M costs generally increase for both types of systems as sludge handling complexity increases. However, given the fact that there is wide scatter in these data, it is presumptuous to claim that there are distinguishable differences in O&M costs for the various combinations studied even though the regression lines are, in fact, different. The conclusion is that more analysis and/or more information is needed.

Regional - Information on total O&M costs within each of the ten EPA Regions is presented in Figures 3.7 through 3.16. In terms of $r^2$ and shaded band width (data scatter), these plots demonstrate a better fit

## TOTAL O & M COSTS vs DESIGN FLOW
### COMPARISON: SLUDGE HANDLING COMPLEXITY
### SECONDARY WASTEWATER TREATMENT PLANTS

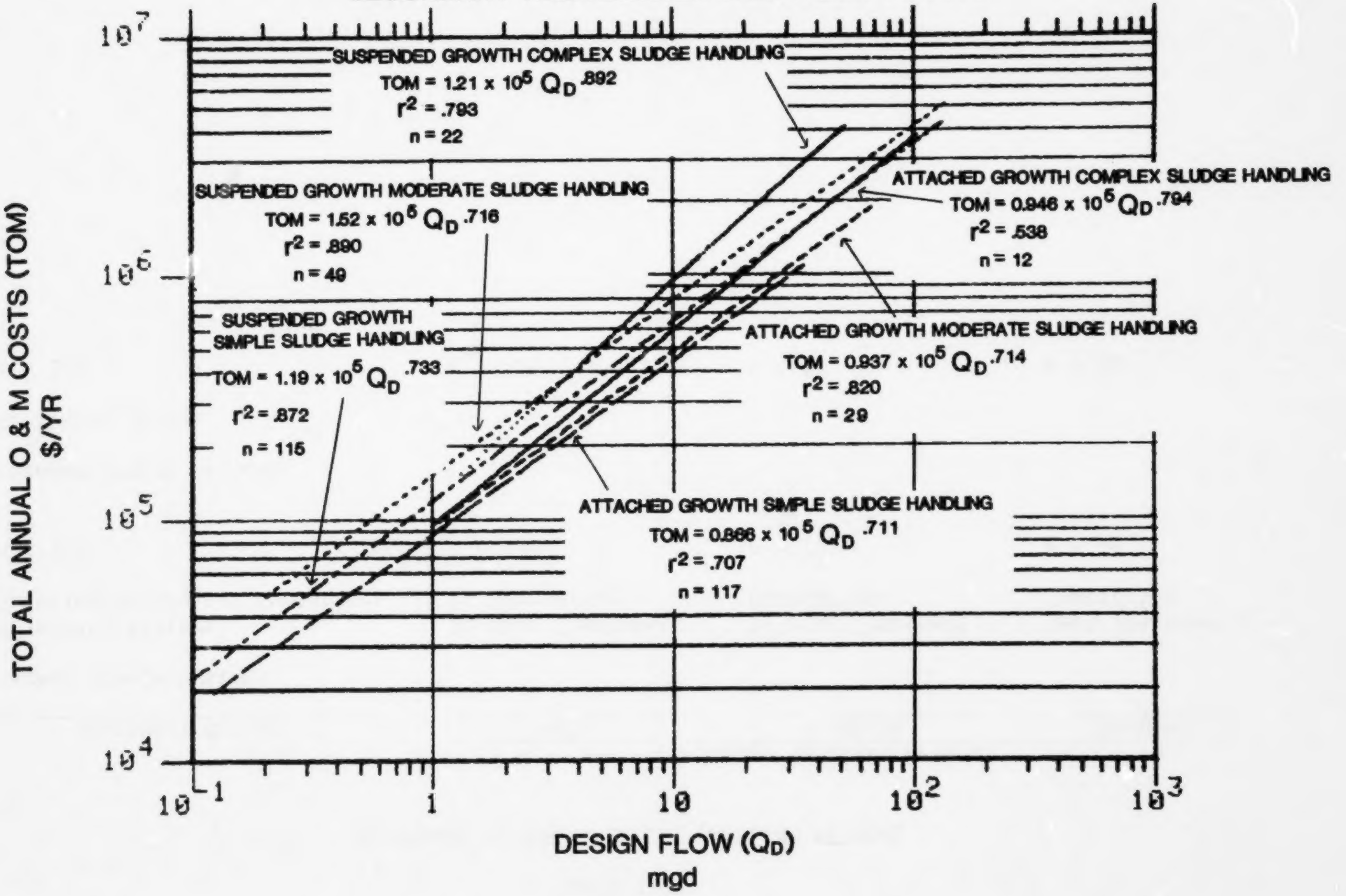


FIGURE 3.6

## TABLE 3.2

## SECONDARY TREATMENT SLUDGE HANDLING METHODS

| Treatment Method | Sludge Handling Method | | |
|---|---|---|---|
| | Simple | Moderate | Complex |
| Attached Growth Systems: | | | |
| Trickling Filters<br>Rotating Biological Contactors | No Heat Treatment, No Dewatering | No Heat Treatment, Dewatering | Heat Treatment, Dewatering |
| n = 158 | n = 117 | n = 29 | n = 12 |
| Suspended Growth Systems: | | | |
| Activated Sludge | | | |
| n = 186 | n = 115 | n = 49 | n = 22 |

## TOTAL O & M COSTS vs DESIGN FLOW

EPA REGION 1
SECONDARY WASTEWATER TREATMENT PLANTS

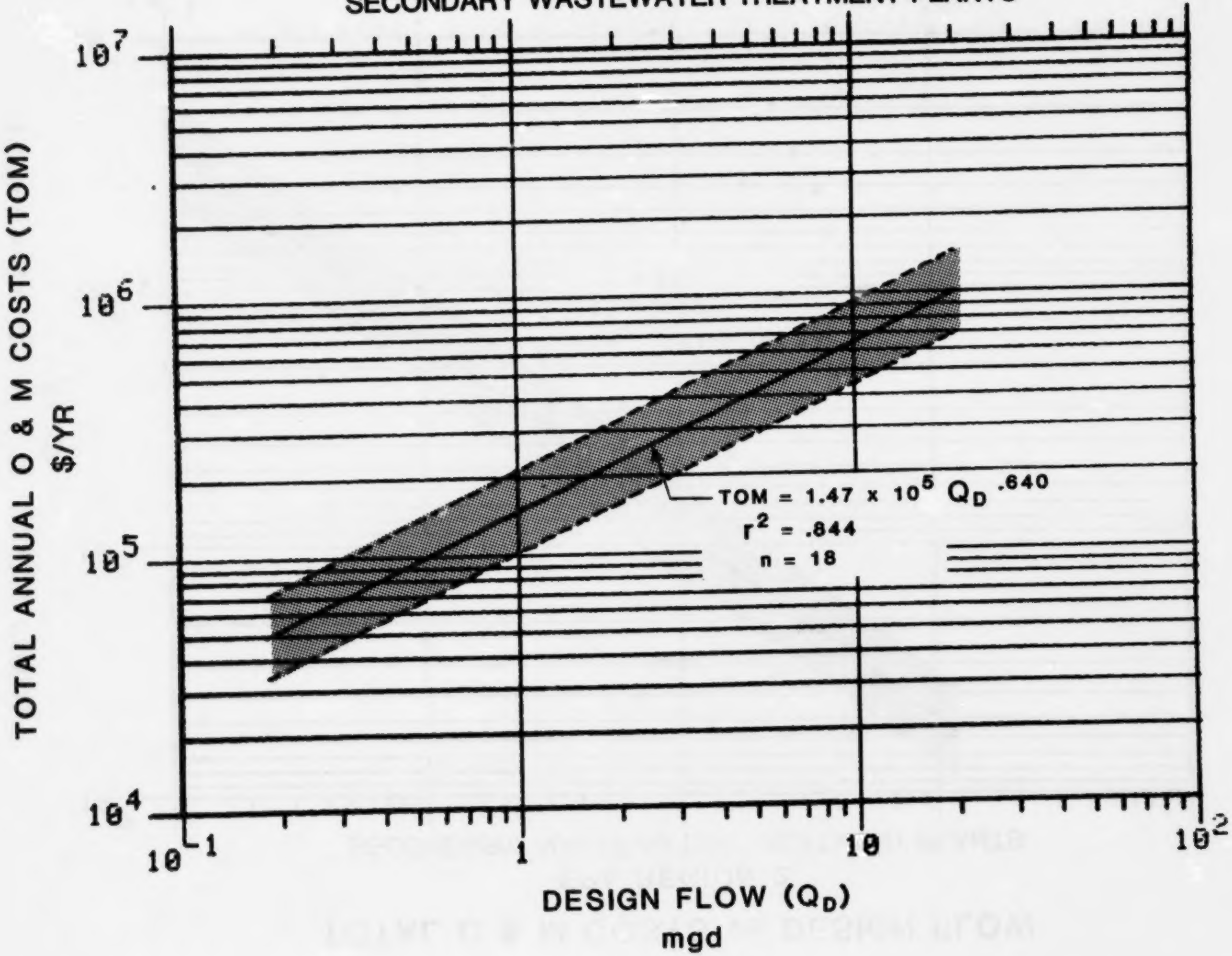


FIGURE 3.7

TOTAL O & M COSTS vs DESIGN FLOW

EPA REGION 2
SECONDARY WASTEWATER TREATMENT PLANTS

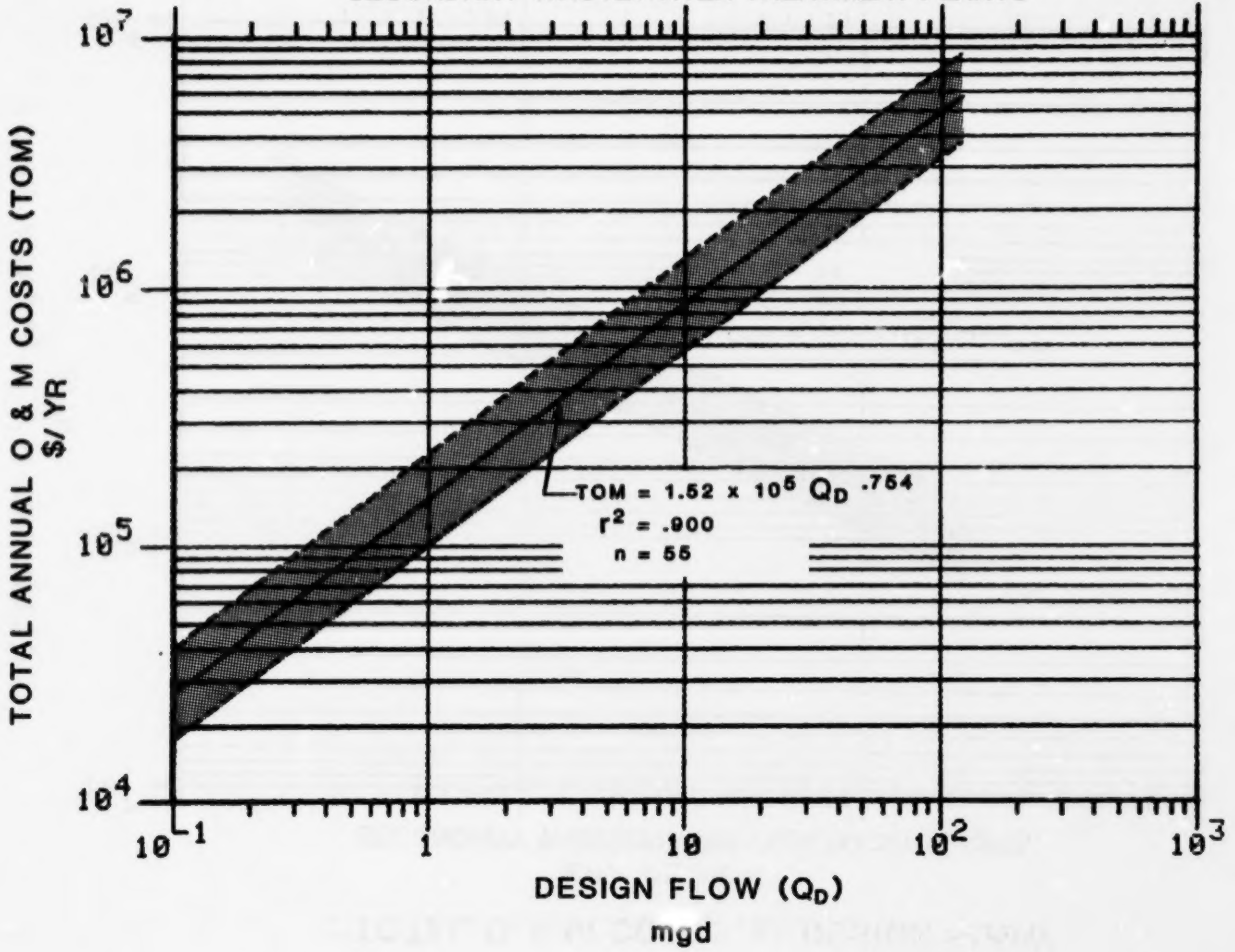
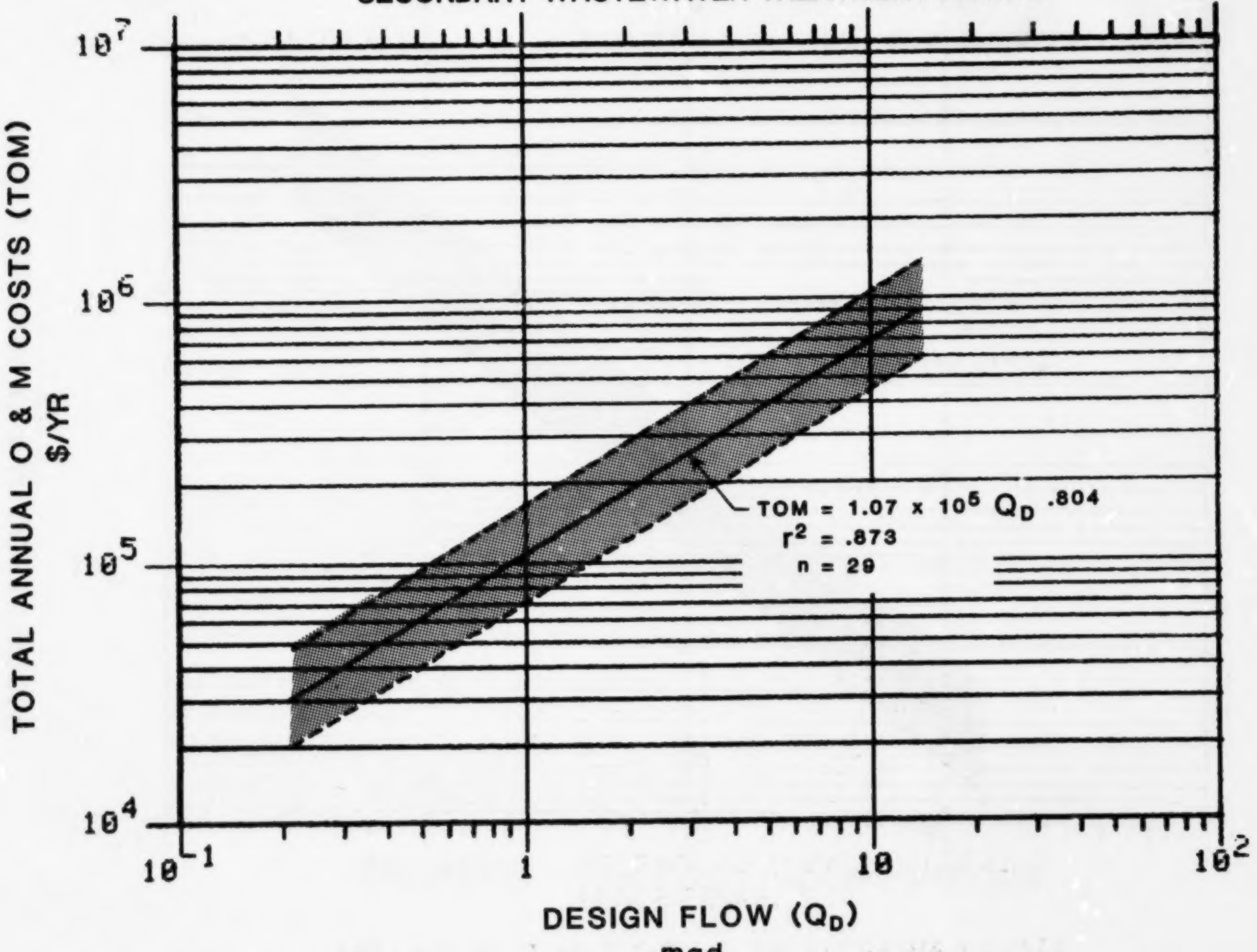


FIGURE 3.8

### TOTAL O & M COSTS vs DESIGN FLOW
EPA REGION 3
SECONDARY WASTEWATER TREATMENT PLANTS



$TOM = 1.07 \times 10^5\ Q_D^{.804}$
$r^2 = .873$
$n = 29$

FIGURE 3.9

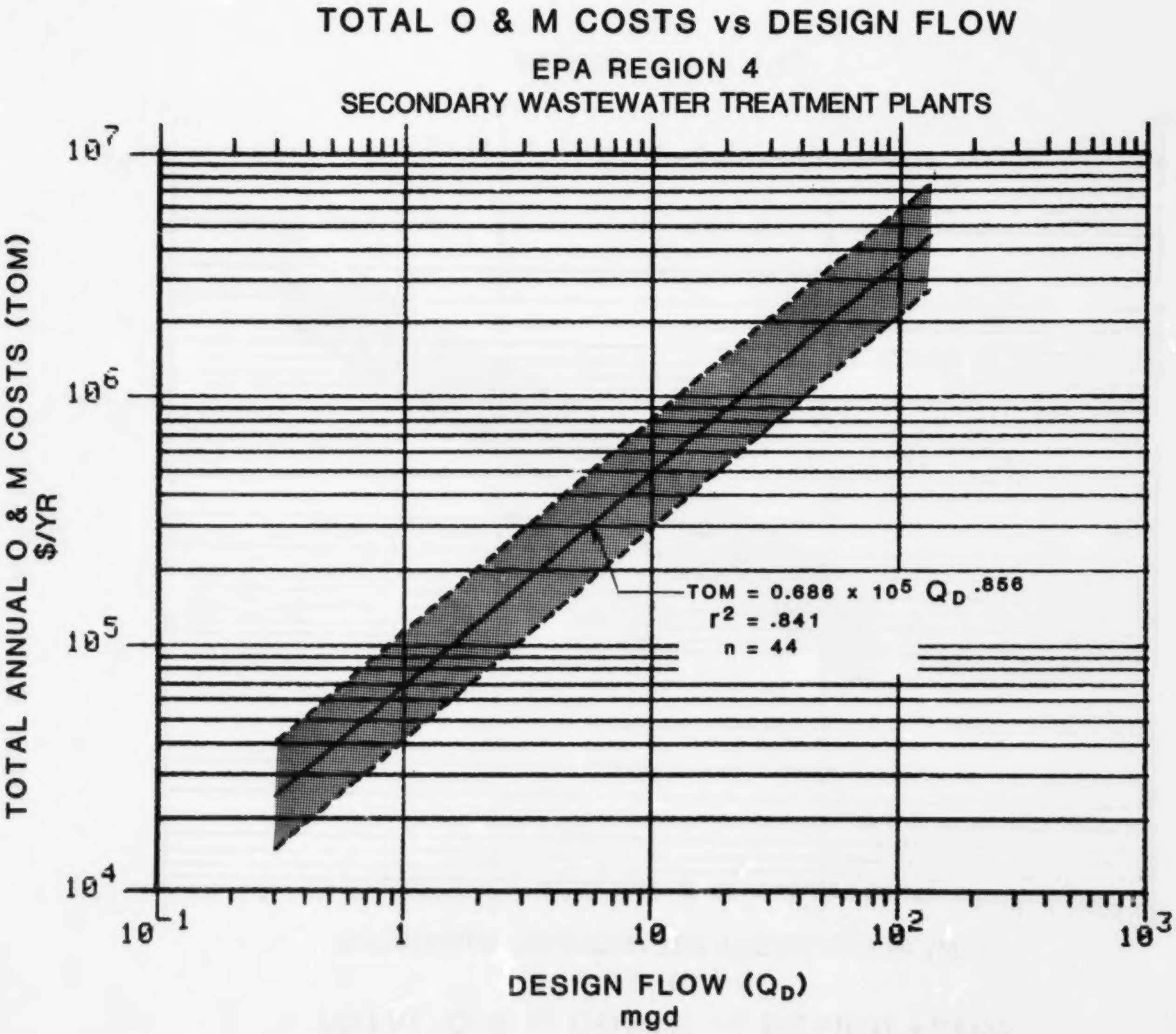

TOTAL O & M COSTS vs DESIGN FLOW
EPA REGION 4
SECONDARY WASTEWATER TREATMENT PLANTS
TOTAL ANNUAL O & M COSTS (TOM)
$/YR
$10^7$
$10^6$
$10^5$
$10^4$
$10^{-1}$
1
10
$10^2$
$10^3$
DESIGN FLOW ($Q_D$)
mgd
$TOM = 0.686 \times 10^5\ Q_D^{.856}$
$r^2 = .841$
n = 44

FIGURE 3.10

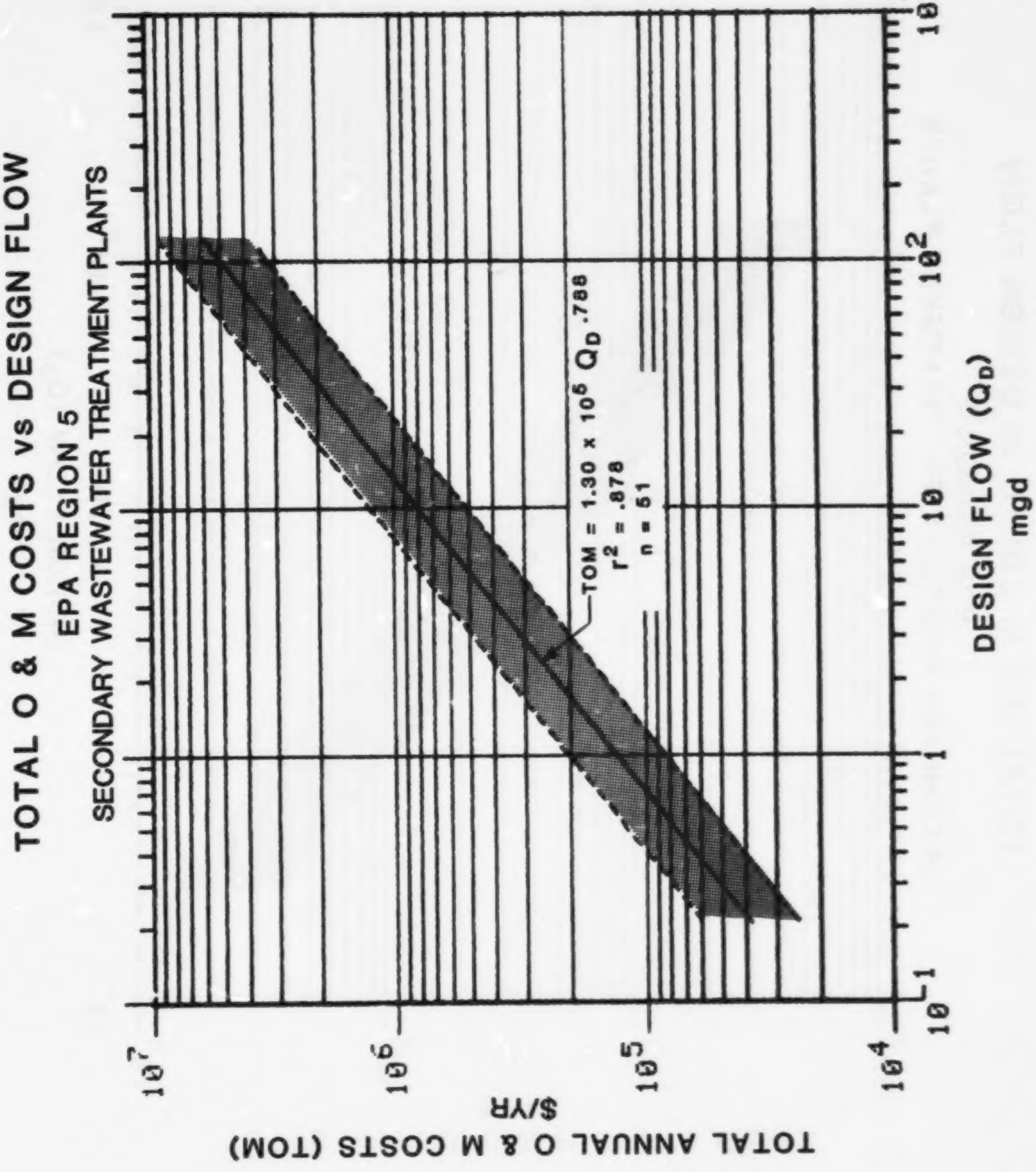

TOTAL O & M COSTS vs DESIGN FLOW
EPA REGION 5
SECONDARY WASTEWATER TREATMENT PLANTS
TOM = 1.30 x $10^5$ $Q_D$ $^{.788}$
$r^2$ = .878
n = 51
TOTAL ANNUAL O & M COSTS (TOM)
$/YR
$10^7$
$10^6$
$10^5$
$10^4$
DESIGN FLOW ($Q_D$)
mgd
$10^{-1}$
1
10
$10^2$
$10^3$

FIGURE 3.11

## TOTAL O & M COSTS vs DESIGN FLOW

EPA REGION 6

SECONDARY WASTEWATER TREATMENT PLANTS

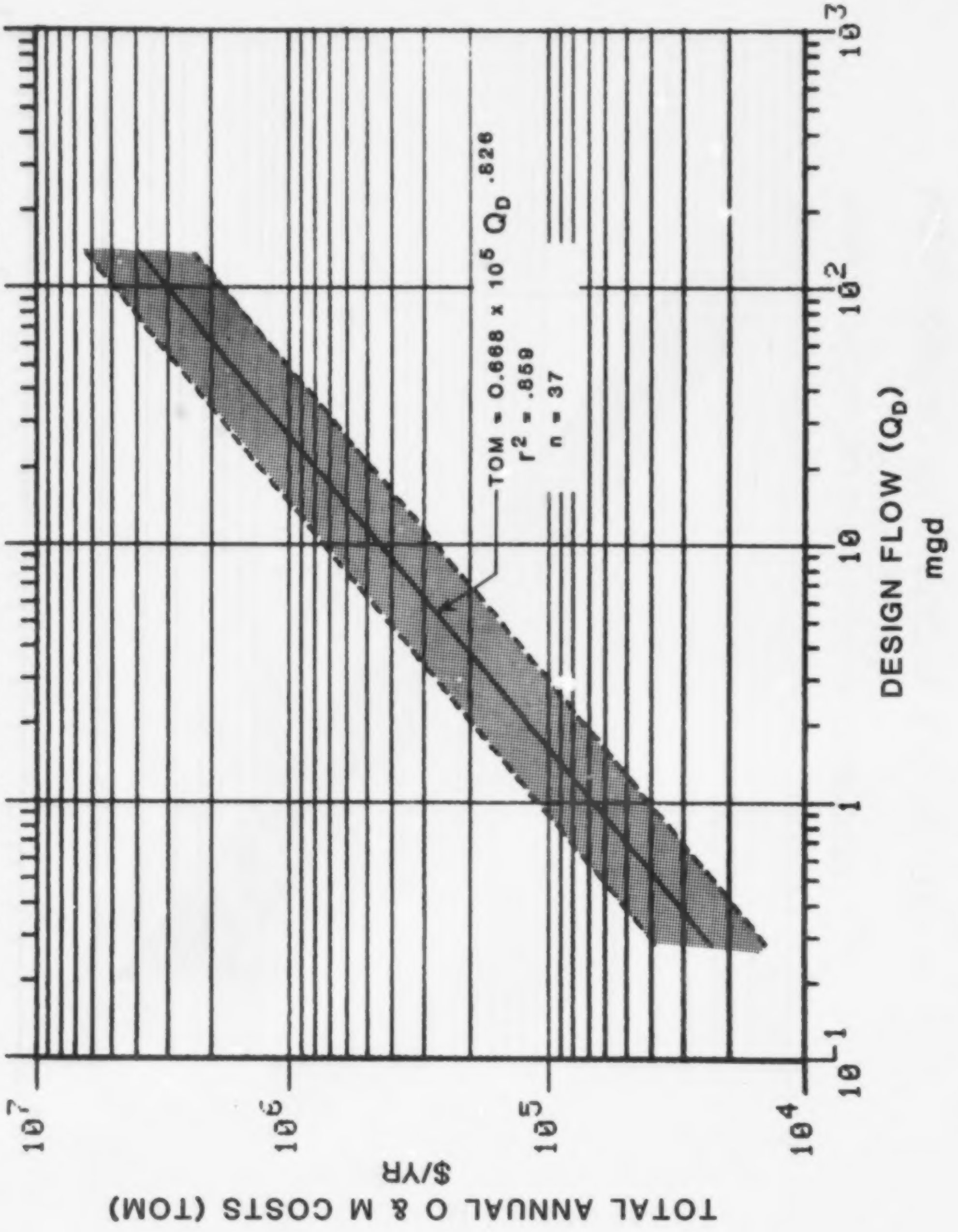


**FIGURE 3.12**

TOTAL O & M COSTS vs DESIGN FLOW

EPA REGION 7

SECONDARY WASTEWATER TREATMENT PLANTS

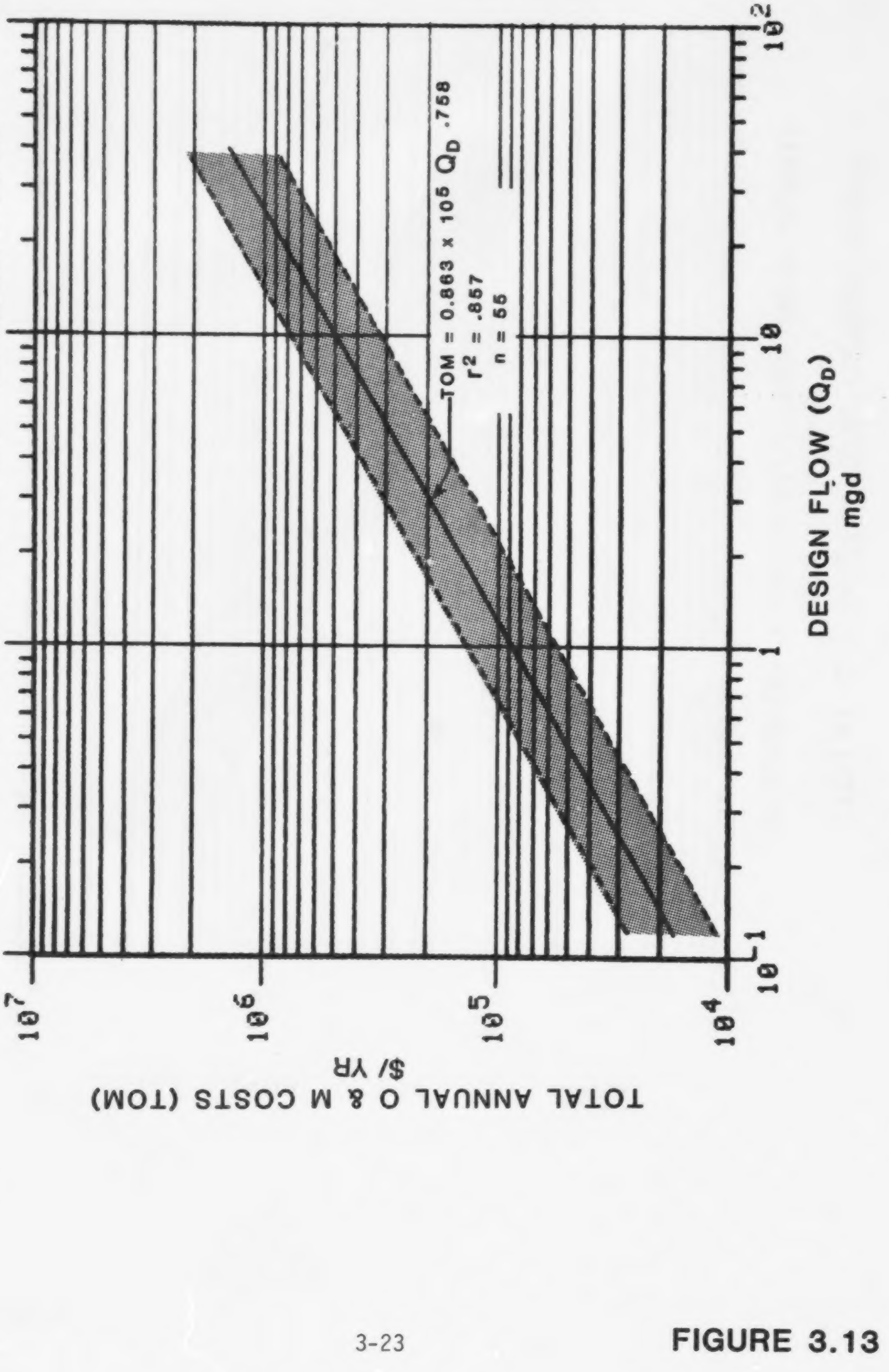


FIGURE 3.13

# TOTAL O & M COSTS vs DESIGN FLOW
## EPA REGION 8
## SECONDARY WASTEWATER TREATMENT PLANTS

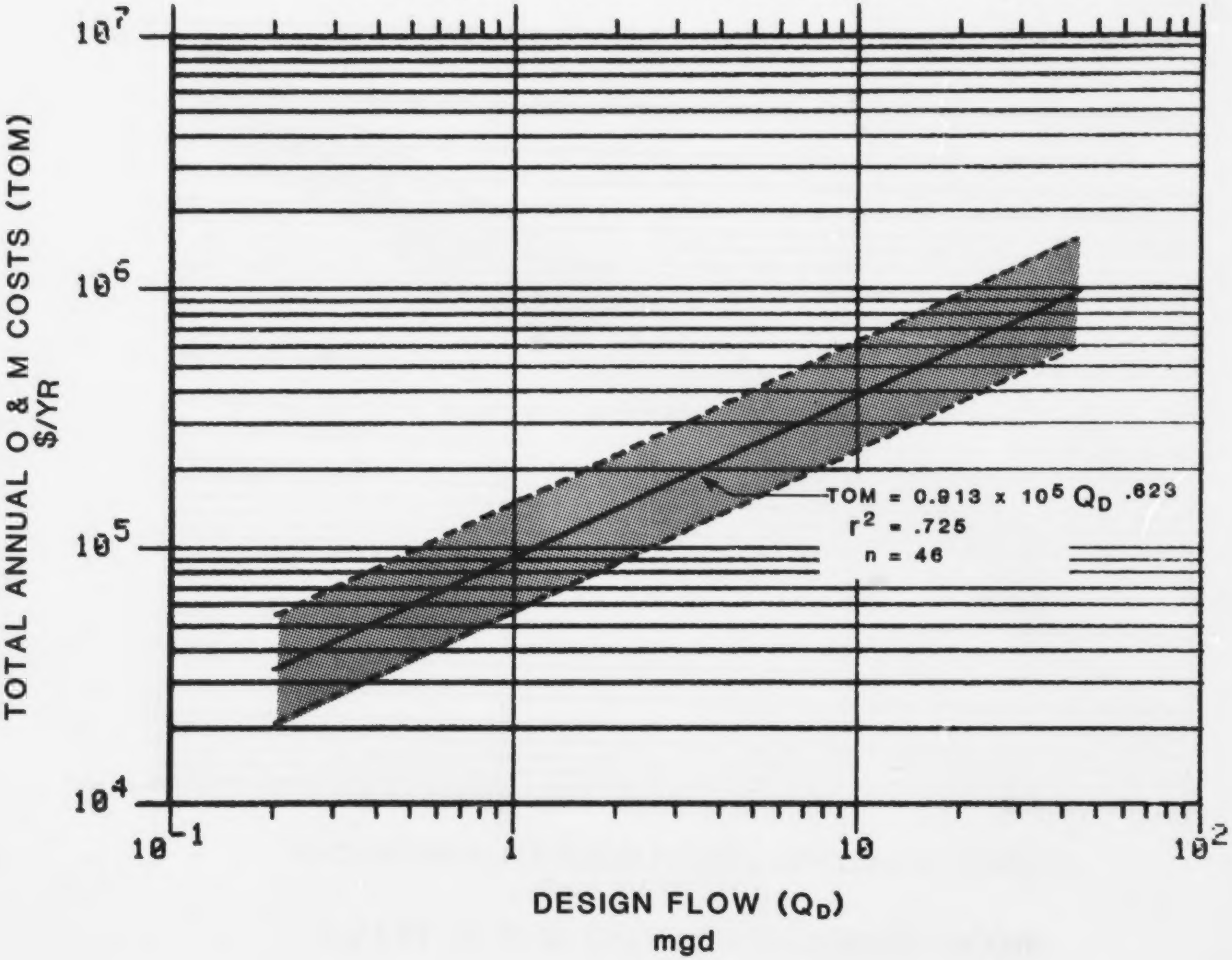


FIGURE 3.14

## TOTAL O & M COSTS vs DESIGN FLOW

### EPA REGION 9
### SECONDARY WASTEWATER TREATMENT PLANTS

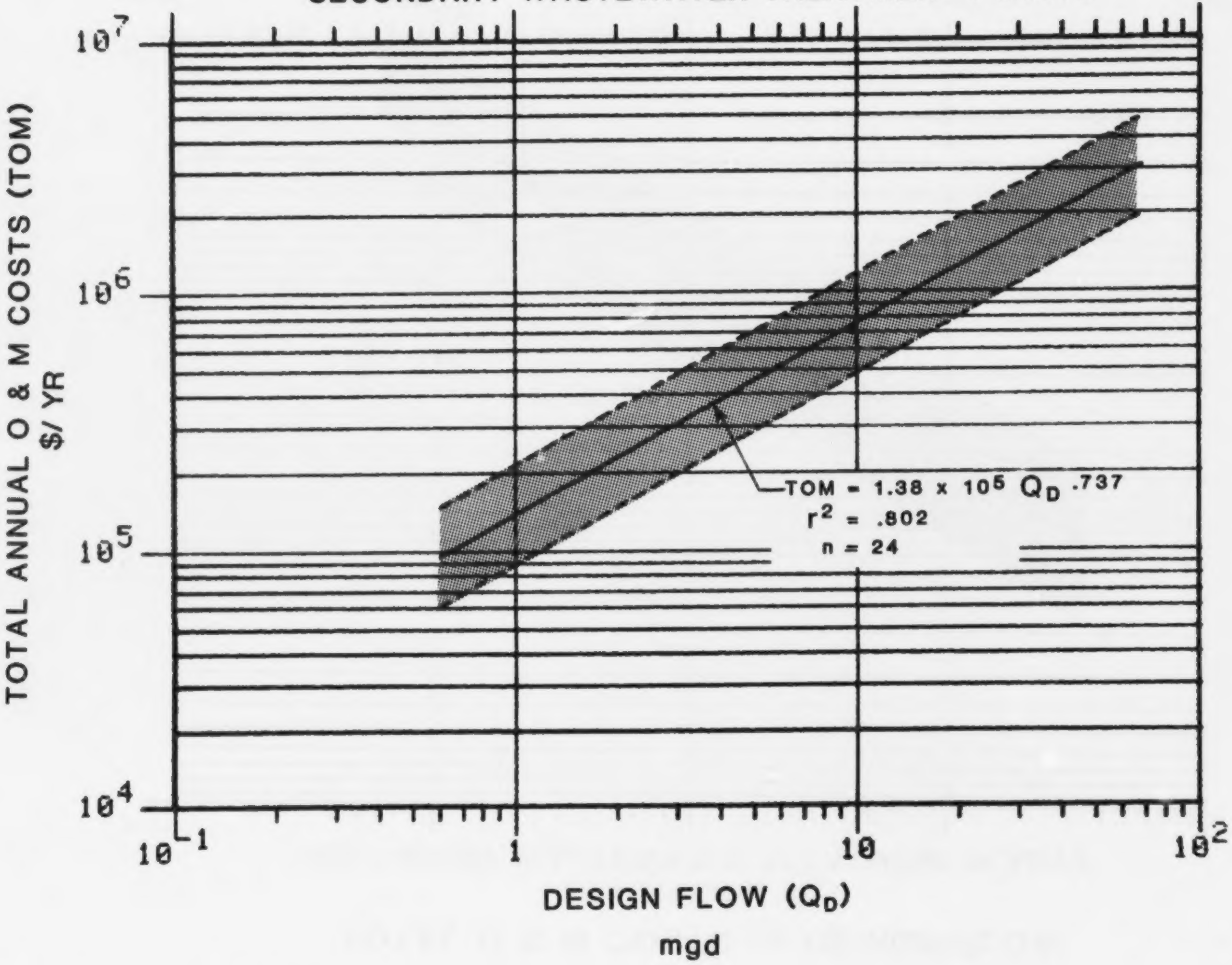


FIGURE 3.15

## TOTAL O & M COSTS vs DESIGN FLOW

### EPA REGION 10
### SECONDARY WASTEWATER TREATMENT PLANTS

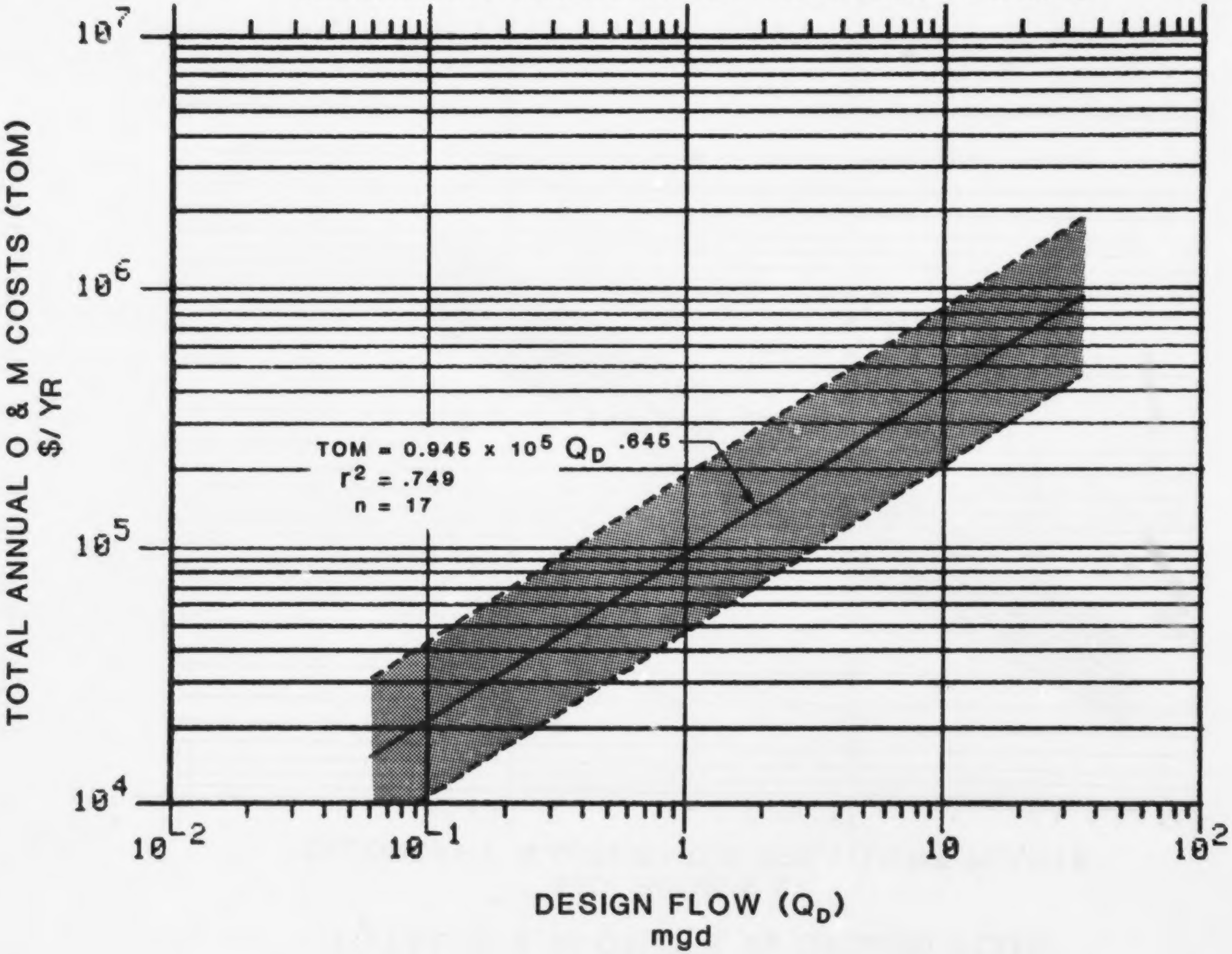


**FIGURE 3.16**

between observed values and the regression plots than did the nationwide data set. This is understandable as analysis of the data by Region should tend to minimize inaccuracies or distortions in the national data presentation caused by factors which are dependent on geographical location. Because of this, the Regional data plots are preferred for estimating the O&M costs of future facilities. Unfortunately, as can be seen by the shaded band width on each Regional plot, the data scatter is such that it is not possible to determine accurately the effect of geographical location on these costs.

These Regional data sets also were split into two subsets of design flow equal to or less than 1.0 mgd and greater than 1.0 mgd and examined by regression analysis. The plots of these analyses are not shown, but did re-emphasize a point made earlier; the data on total O&M costs versus design flow for all Regions show a much higher scatter for those plants with flows equal to or less than 1.0 mgd than for the larger facilities.

Advanced Secondary Treatment Facilities: This study included 209 treatment facilities defined as advanced secondary, i.e., producing a five day BOD effluent concentration of 11 to 24 mg/l. The number of these type facilities proved to be inadequate for analyses distinguishing between Regions; thus, only nationwide information is presented. Figure 3.17 presents the linear regression analysis of these data.

This plot is sufficient to deduce a useful relationship between costs and design flow. However, the data scatter is large as shown by the width of the shaded band and must be given consideration when attempting to predict O&M costs from this graph.

No data were found in the literature with which to compare this plot. However, comparison of the information of Figure 3.17 with that obtained from the CAPDET program (8) is shown in Figure 3.18. The CAPDET program estimates of total annual O&M costs are somewhat higher than those found by this study. Perhaps the default data used in CAPDET are on the conservative side for advanced secondary systems, i.e., yield higher costs values.

Figure 3.19 presents total annual O&M costs as a function of design flow by type of sludge handling for advanced secondary facilities. No segregation of treatment methods was attempted because few trickling filter plants reported BOD effluent concentrations of less than 24 mg/l. Thus, the data reflect primarily activated sludge systems with sludge handling as shown in Table 3.3.

Total annual O&M costs might logically be expected to increase with increasing complexity of sludge handling. The regression line plots for the three types of sludge handling shown on Figure 3.19 demonstrate this over the range studied.

# TOTAL O & M COSTS vs DESIGN FLOW

## ADVANCED SECONDARY WASTEWATER TREATMENT PLANTS

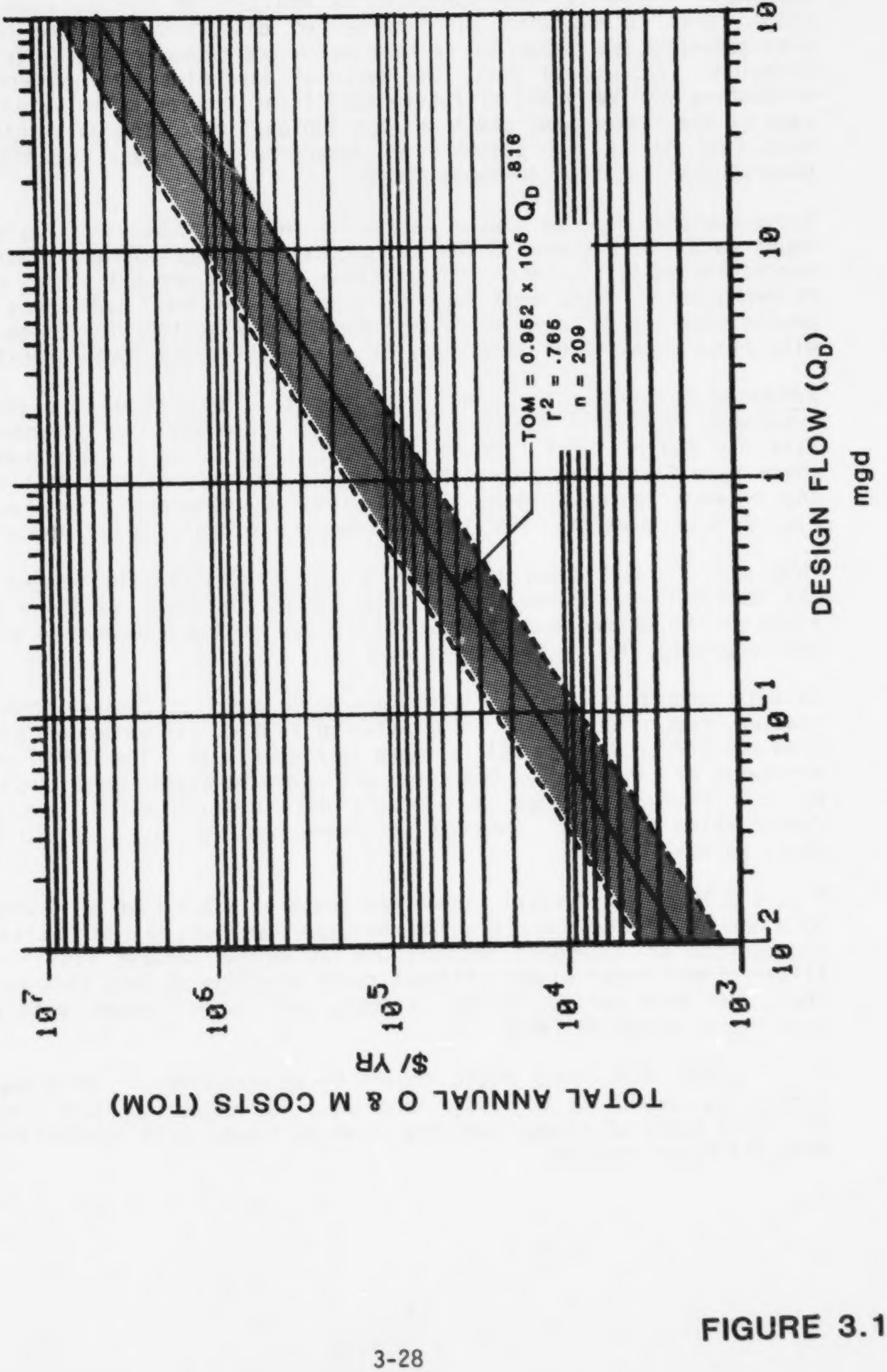


FIGURE 3.17

## TOTAL O & M COSTS vs DESIGN FLOW
COMPARISON: CAPDET VALUES
ADVANCED SECONDARY WASTEWATER TREATMENT PLANTS

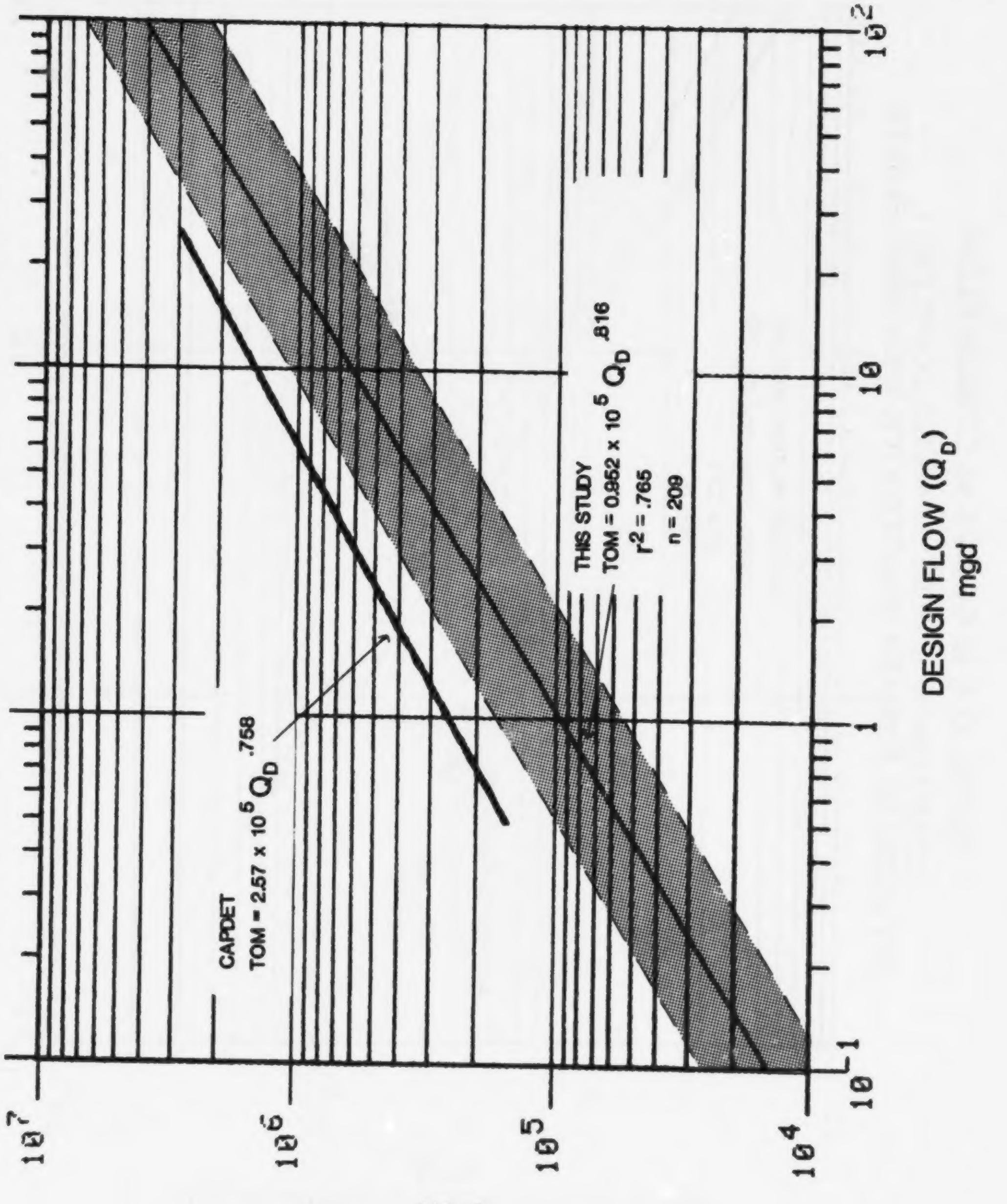


FIGURE 3.18

## TOTAL O & M COSTS vs DESIGN FLOW

COMPARISON: SLUDGE HANDLING COMPLEXITY
ADVANCED SECONDARY WASTEWATER TREATMENT PLANTS

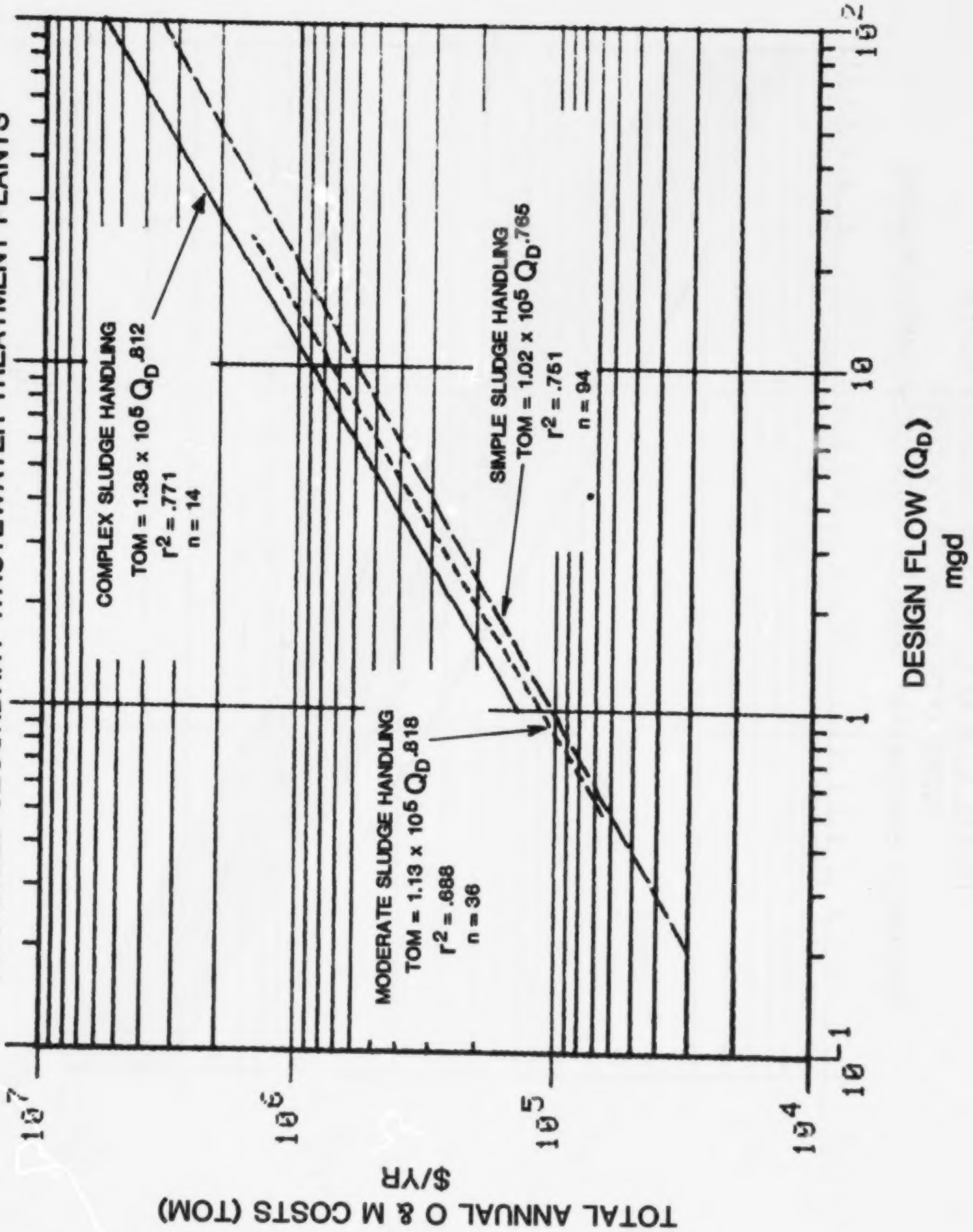


**FIGURE 3.19**

## TABLE 3.3

## ADVANCED SECONDARY TREATMENT SLUDGE HANDLING METHODS

| Simple | Moderate | Complex |
|---|---|---|
| No Heat Treatment,<br>No Dewatering | No Heat Treatment,<br>Dewatering | Heat Treatment,<br>Dewatering |
| n = 94 | n = 36 | n = 14 |

The full data set on O&M costs versus design flow for advanced secondary facilities also was examined for plants with flows equal to or less than 1.0 mgd and greater than 1.0 mgd. Most of the facilities--169 out of 209--were of a design flow size greater than 1.0 mgd. The $r^2$ value was better for the full data set ($r^2 = 0.765$) than for either of the subsets, suggesting that something other than plant size introduces a significant amount of the uncertainty inherent in these data. For example, such things as variation in the costs of labor, power, and chemicals resulting from geographical differences might well impact these O&M costs significantly.

Advanced Wastewater Treatment Facilities: Figure 3.20 is a presentation of total annual O&M costs for the 86 plants studied which are categorized as advanced wastewater treatment facilities, i.e., producing five day BOD effluent concentrations of 10 mg/l or less. The observed data fit the regression line produced from them moderately well and should serve as an adequate guide for estimating the O&M costs for such facilities when used with caution and judgment. No Regionalized analyses were done for these high performance systems because of the small number of them in each Region.

As with the other types of facilities, the data set on O&M costs as a function of design flow for advanced facilities was analyzed for the two subsets of plants with flows equal to or less than 1.0 mgd and greater than 1.0 mgd. No new information was derived from this exercise. About two-thirds (57 of 86) of these plants had design flows greater than 1.0 mgd. Again, the $r^2$ values for both subsets were less than for the full data set, suggesting the importance of factors other than design flow in the determination of O&M costs.

A comparison of the linear regression plot from Figure 3.20 with O&M costs produced by the CAPDET program (8) is shown in Figure 3.21. This comparison shows the O&M costs for the advanced wastewater treatment facilities of this study to be generally lower than predicted by CAPDET. As noted for advanced secondary systems, no explanation of this observation is apparent. However, it could be that the generalized cost data used by CAPDET produce conservative (higher) estimates of total O&M costs for advanced wastewater treatment plants. This is not illogical as CAPDET was developed before there were many operative AWT plants from which to collect O&M data.

Figure 3.22 isolates the O&M cost data obtained from several advanced wastewater treatment facilities in terms of the way their sludges are handled, as described in Table 3.4.

Over the range of design flows studied--and apparently for a considerable distance outside this range--the data match logic; total O&M costs are directly related to the complexity of the sludge handling procedure. This observation fits that encountered for advanced secondary systems and, in general, for secondary systems.

## TOTAL O & M COSTS vs DESIGN FLOW

### ADVANCED WASTEWATER TREATMENT PLANTS

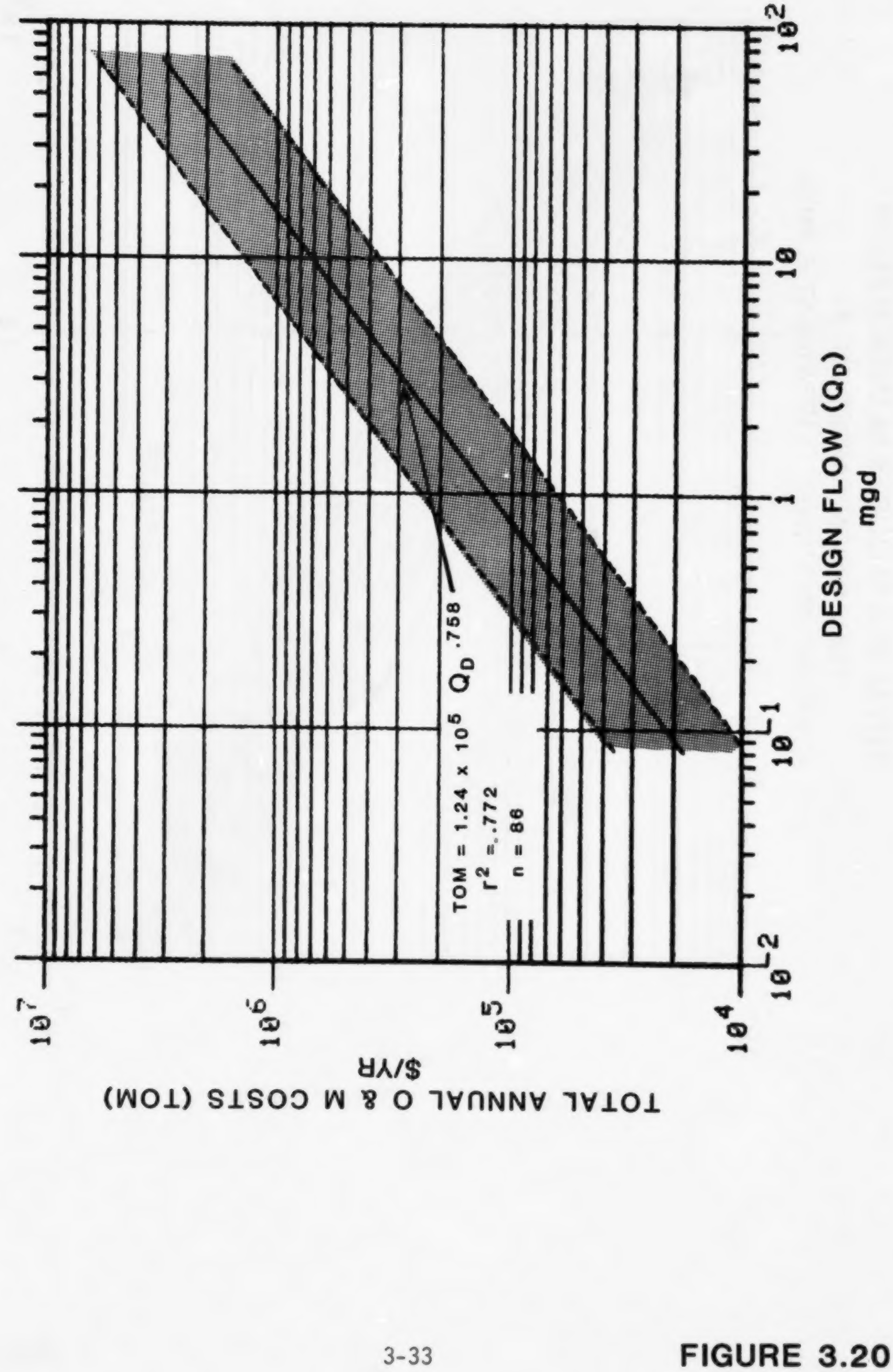


**FIGURE 3.20**

## TOTAL O & M COSTS vs DESIGN FLOW
### COMPARISON: CAPDET VALUES
### ADVANCED WASTEWATER TREATMENT PLANTS

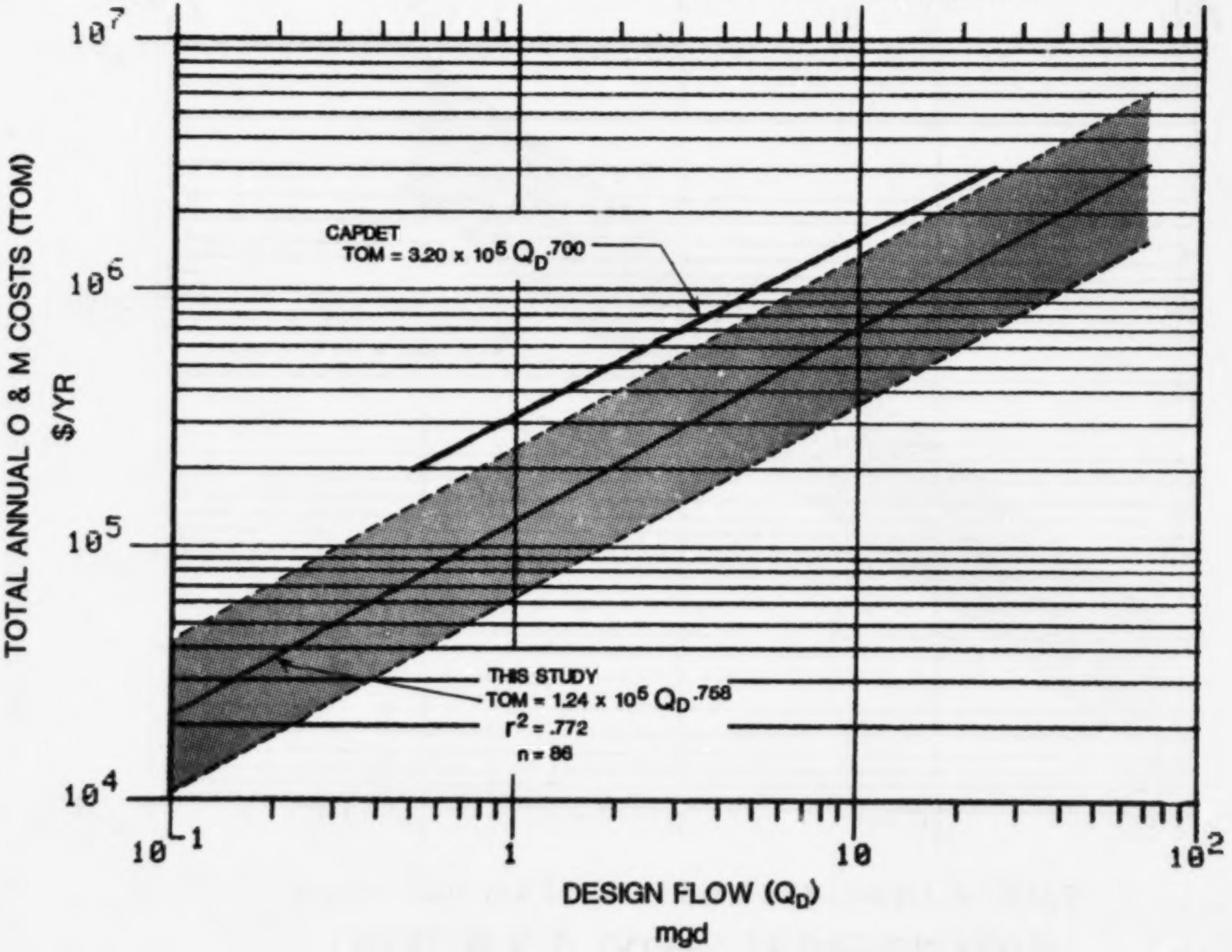


FIGURE 3.21

## TOTAL O & M COSTS vs DESIGN FLOW
### COMPARISON: SLUDGE HANDLING COMPLEXITY
### ADVANCED WASTEWATER TREATMENT PLANTS

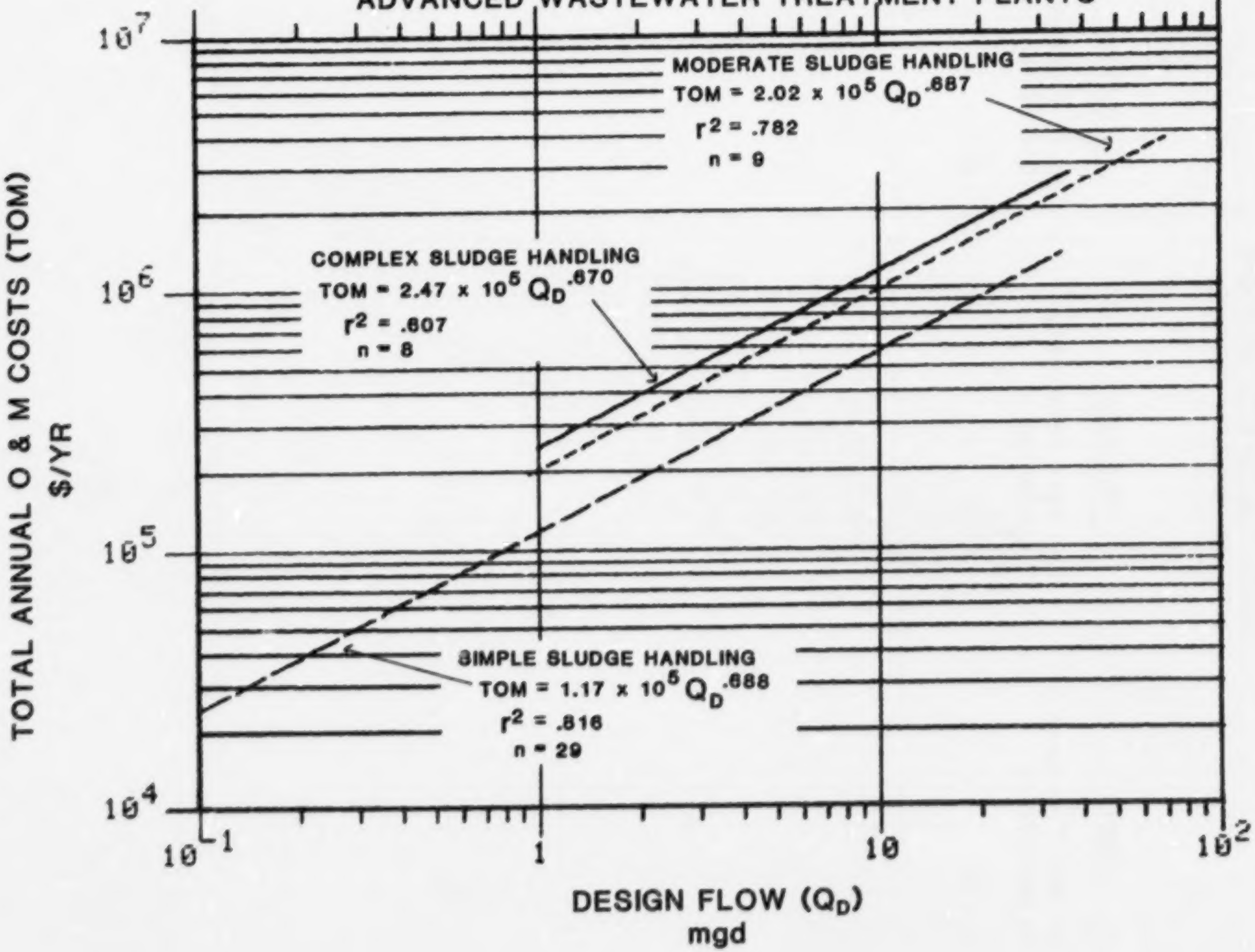


FIGURE 3.22

## TABLE 3.4

## ADVANCED WASTEWATER TREATMENT SLUDGE HANDLING METHODS

| Simple | Moderate | Complex |
|---|---|---|
| No Heat Treatment,<br>No Dewatering | No Heat Treatment,<br>Dewatering | Heat Treatment,<br>Dewatering |
| n = 29 | n = 9 | n = 8 |

Summary and Comparison - Total Annual O&M Costs for Treatment Plants: The regression equations obtained from the nationwide data sets of total annual O&M costs for secondary, advanced secondary, and advanced wastewater treatment facilities were compared against one another. The plot of these equations is contained in Figure 3.23. Figures 3.24 and 3.25 also show similar plots for the two data subsets of plants with design flow equal to or less than 1.0 mgd and greater than 1.0 mgd, respectively. This comparison suggests that advanced wastewater treatment is somewhat more costly of O&M dollars than the lower degrees of treatment over the range of plant size investigated. In Figure 3.24 the ordering of O&M costs (highest to lowest) to treatment level is AWT, secondary, and advanced secondary. In Figure 3.25 this ordering is from AWT to advanced secondary to secondary. However, when data scatter previously noted for the three individual cases is considered, it must be concluded that there are no significant differences in the total O&M costs reported for the three levels of treatment.

Because of this conclusion, the data from plants of all three treatment levels were treated as a single data set and analyzed. This regression, as shown in Figure 3.26, supports the conclusion of no significant differences in the total annual O&M costs between secondary, advanced secondary, and advanced wastewater treatment plants. As shown in Table 3.5, regression equations, $r^2$ values, and shaded band widths are comparable for each of the individual levels of treatment and for the composite of treatment levels. Thus, Figure 3.26 is as adequate as Figures 3.3, 3.17, or 3.20 for determining the estimated total O&M costs for either of the three levels of treatment.

## Sludge Handling Costs

Earlier information (2) indicated that expenditures for solids handling might be a significant part of the total O&M costs of treatment facilities--perhaps 20 to 30 percent of the total. However, there is little information to substantiate or refute this point. Thus, it seemed useful in this effort to examine the O&M cost attributable to the handling and disposing of sludge.

As used here, the term sludge handling O&M costs refers to all O&M costs incurred in handling, treating, dewatering, and/or disposing of the sludge once it leaves the clarifiers of the systems under study. These costs, of course, were included in the total treatment facility O&M costs reported earlier, but are dealt with here separately.

Sludge handling O&M costs are reported as a function of actual plant flow and as a function of dry solids production. All of the plants studied were municipal facilities. It was assumed that their waste strength and composition would be roughly comparable, making flow and dry solids production reasonable bases for comparing sludge handling O&M costs.

## TOTAL O & M COSTS vs DESIGN FLOW

COMPARISON: TREATMENT LEVELS
SECONDARY, ADVANCED SECONDARY,
AND ADVANCED WASTEWATER TREATMENT PLANTS

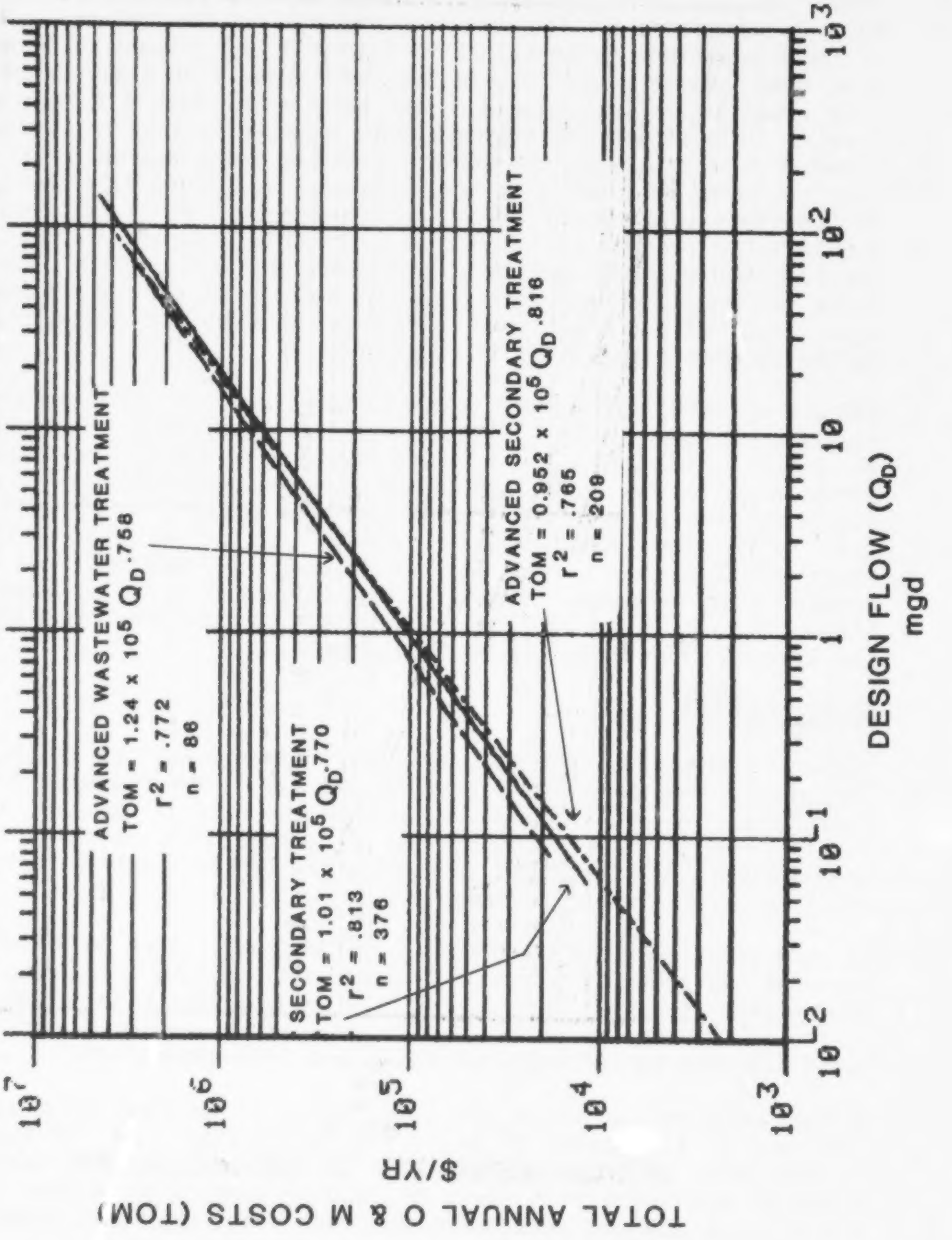


FIGURE 3.23

TOTAL O & M COSTS vs DESIGN FLOW
COMPARISON: TREATMENT LEVELS, $Q_D \leq 1.0$ mgd
SECONDARY, ADVANCED SECONDARY,
AND ADVANCED WASTEWATER TREATMENT PLANTS

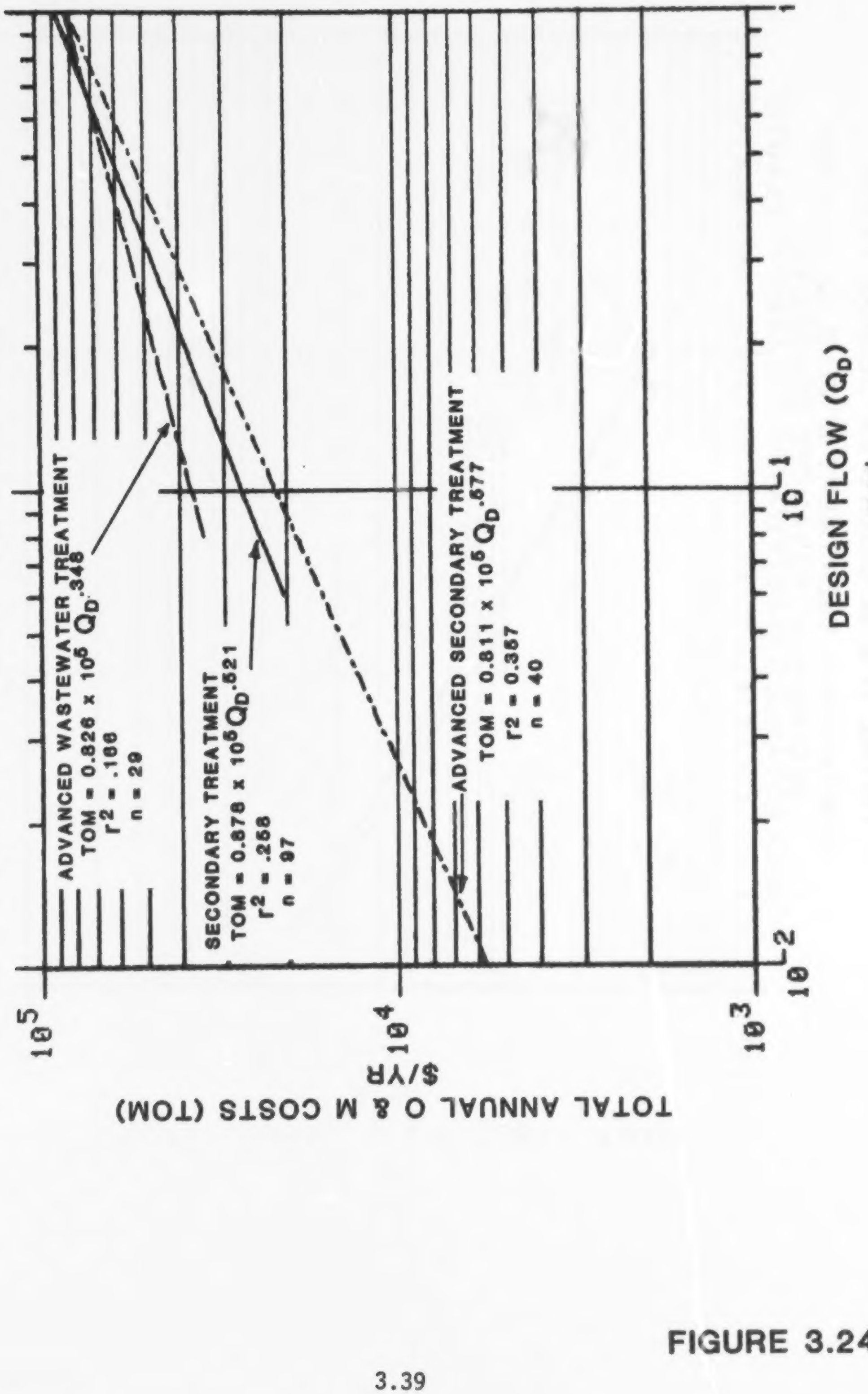
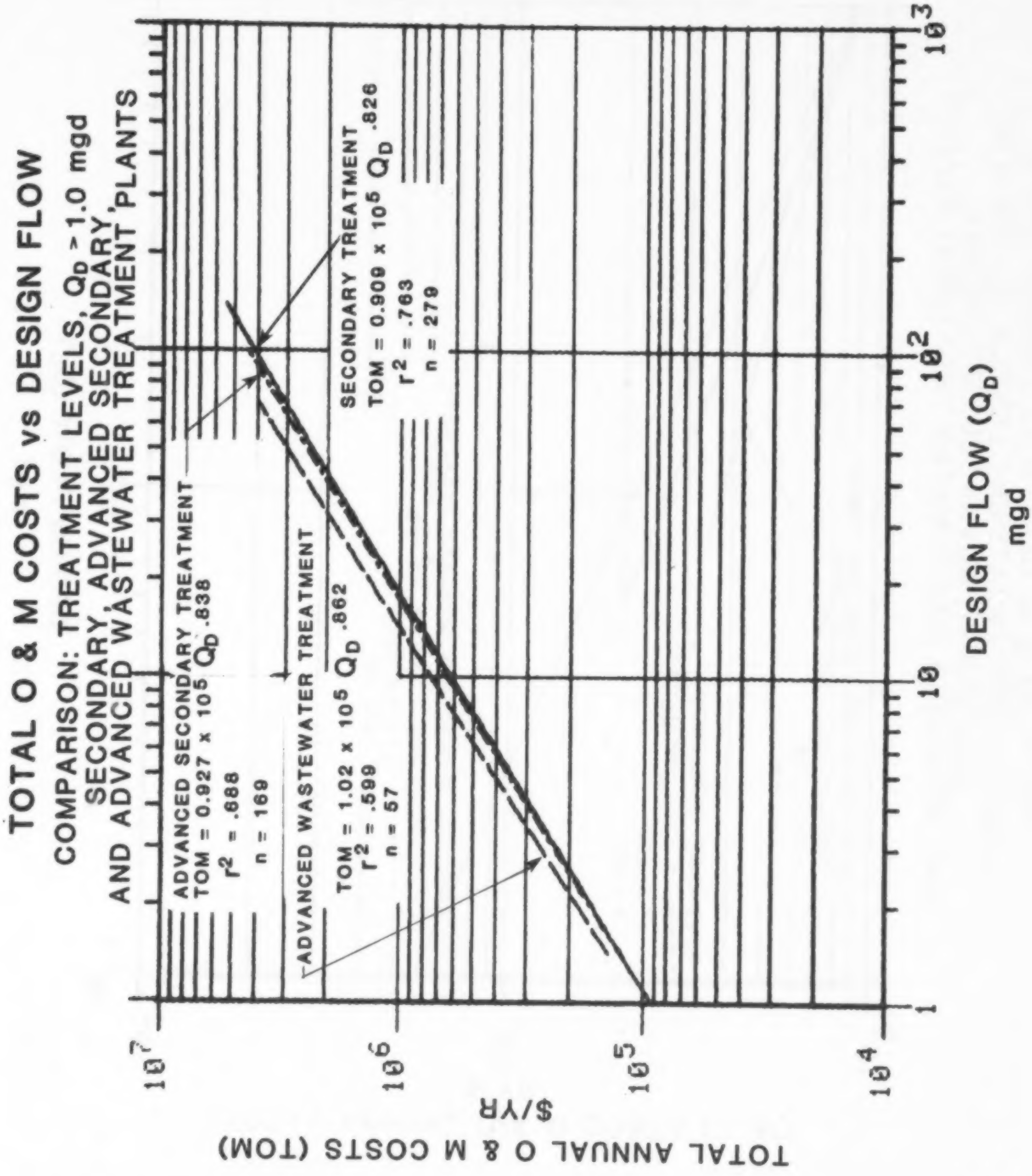


FIGURE 3.24


TOTAL O & M COSTS vs DESIGN FLOW

COMPARISON: TREATMENT LEVELS, $Q_D > 1.0$ mgd SECONDARY, ADVANCED SECONDARY, AND ADVANCED WASTEWATER TREATMENT PLANTS

FIGURE 3.25

**TOTAL O & M COSTS vs DESIGN FLOW**
ALL TREATMENT LEVEL COMPOSITE
SECONDARY, ADVANCED SECONDARY , AND
ADVANCED WASTEWATER TREATMENT PLANTS

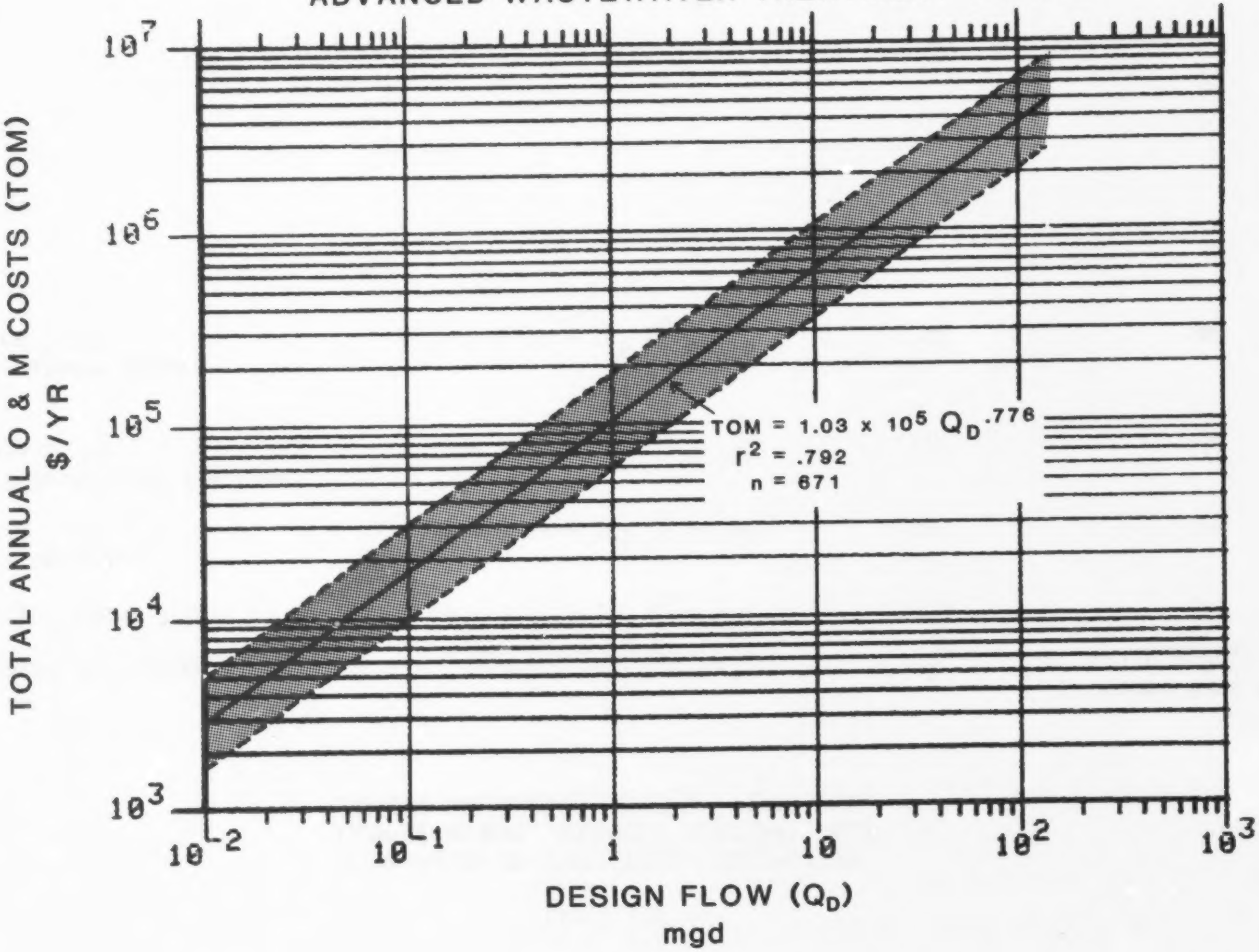


FIGURE 3.26

## TABLE 3.5

### COMPARISON OF STATISTICAL INFORMATION FROM SECONDARY, ADVANCED SECONDARY, AND ADVANCED WASTEWATER TREATMENT PLANT DATA

| Level of Treatment | Regression Equation | $r^2$ | Shaded Band Width @ 1.0 mgd (1,000) |
|---|---|---|---|
| Secondary (Figure 3.3) | $\$ = 1.01 \times 10^5 Q_D{}^{0.770}$ | .813 | 120 |
| Advanced Secondary (Figure 3.17) | $\$ = 0.95 \times 10^5 Q_D{}^{0.816}$ | .765 | 125 |
| Advanced Wastewater Treatment (Figure 3.20) | $\$ = 1.24 \times 10^5 Q_D{}^{0.758}$ | .772 | 180 |
| Summary:<br>All Treatment Levels (Figure 3.23) | $\$ = 1.03 \times 10^5 Q_D{}^{0.776}$ | .792 | 140 |

Linear regression analyses were performed for sludge handling costs as a function of actual plant flow for secondary, advanced secondary, and advanced wastewater treatment systems. These analyses showed little significant difference in sludge handling costs between the three levels of treatment over the range of plant sizes studied. For this reason, a regression of sludge handling costs as a function of actual plant flow for all treatment levels was done and is shown in Figure 3.27.

The statistical information on this plot is not good. The $r^2$ is quite low (.406) and the data scatter is large. However, this plot is as significant statistically as those obtained from the regression analysis of each treatment level. Consideration of Figure 3.27 suggests that other factors, for example individual plant sludge handling procedures, may be a more important determinant of O&M costs for sludge handling than the actual plant flow.

Regression analysis also was performed on sludge handling costs as a function of dry solids production for each of the three levels of treatment. These analyses provide little in the way of confidence about the relationship between the two parameters; thus, their results are not shown. Statistically there was little difference in the relationship of sludge handling costs and solids production between the three treatment levels. Because of this a single plot of sludge handling annual costs as a function of solids production, using the data from all three levels of treatment, was developed and is presented in Figure 3.28. This plot may be used as the general expression of sludge handling costs versus solids production.

### Components of O&M Costs

Earlier work (2) established five major components of total annual O&M costs, e.g., personnel, utilities, chemicals, equipment and materials, contractual and other. Table 3.6 presents information on the national average cost of each of these five components. It also compares these values with similar values taken from the literature (2) and updated to 1st Quarter 1981.

In evaluating the information in Table 3.6, it should be noted that the component size given for "this study" is the sum of the ratio between the individual component costs and the total O&M costs for a particular wastewater treatment plant, divided by the available data points for that particular component cost, expressed as a percentage. The equation is shown below.

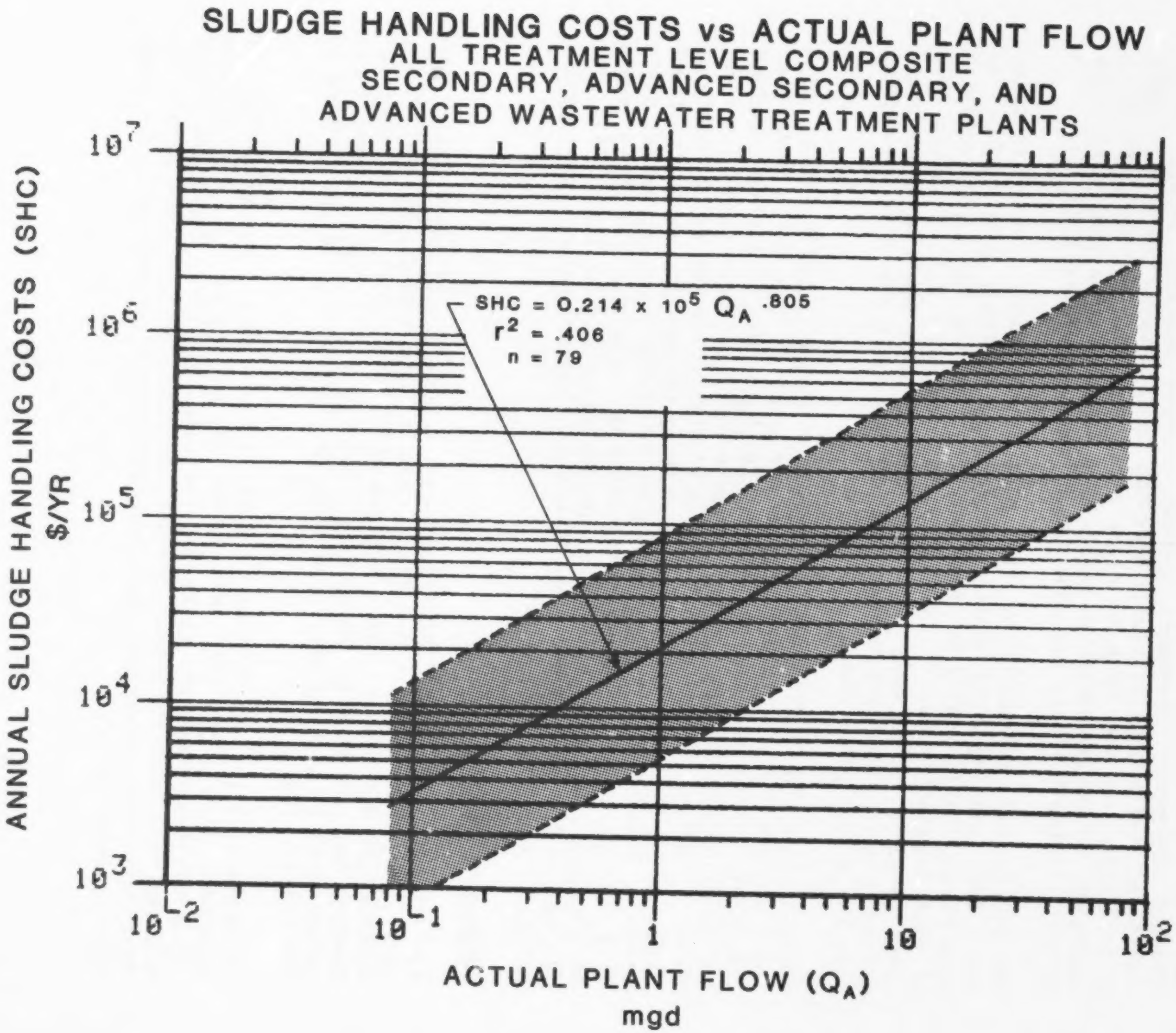

SLUDGE HANDLING COSTS vs ACTUAL PLANT FLOW
ALL TREATMENT LEVEL COMPOSITE
SECONDARY, ADVANCED SECONDARY, AND
ADVANCED WASTEWATER TREATMENT PLANTS
SHC = 0.214 x 10^5 Q_A ^.805
r^2 = .406
n = 79
ANNUAL SLUDGE HANDLING COSTS (SHC)
$/YR
10^7
10^6
10^5
10^4
10^3
10^-2
10^-1
1
10
10^2
ACTUAL PLANT FLOW (Q_A)
mgd

FIGURE 3.27

## SLUDGE HANDLING COSTS vs SOLIDS PRODUCTION
ALL TREATMENT LEVEL COMPOSITE
SECONDARY, ADVANCED SECONDARY,
AND ADVANCED WASTEWATER TREATMENT PLANTS

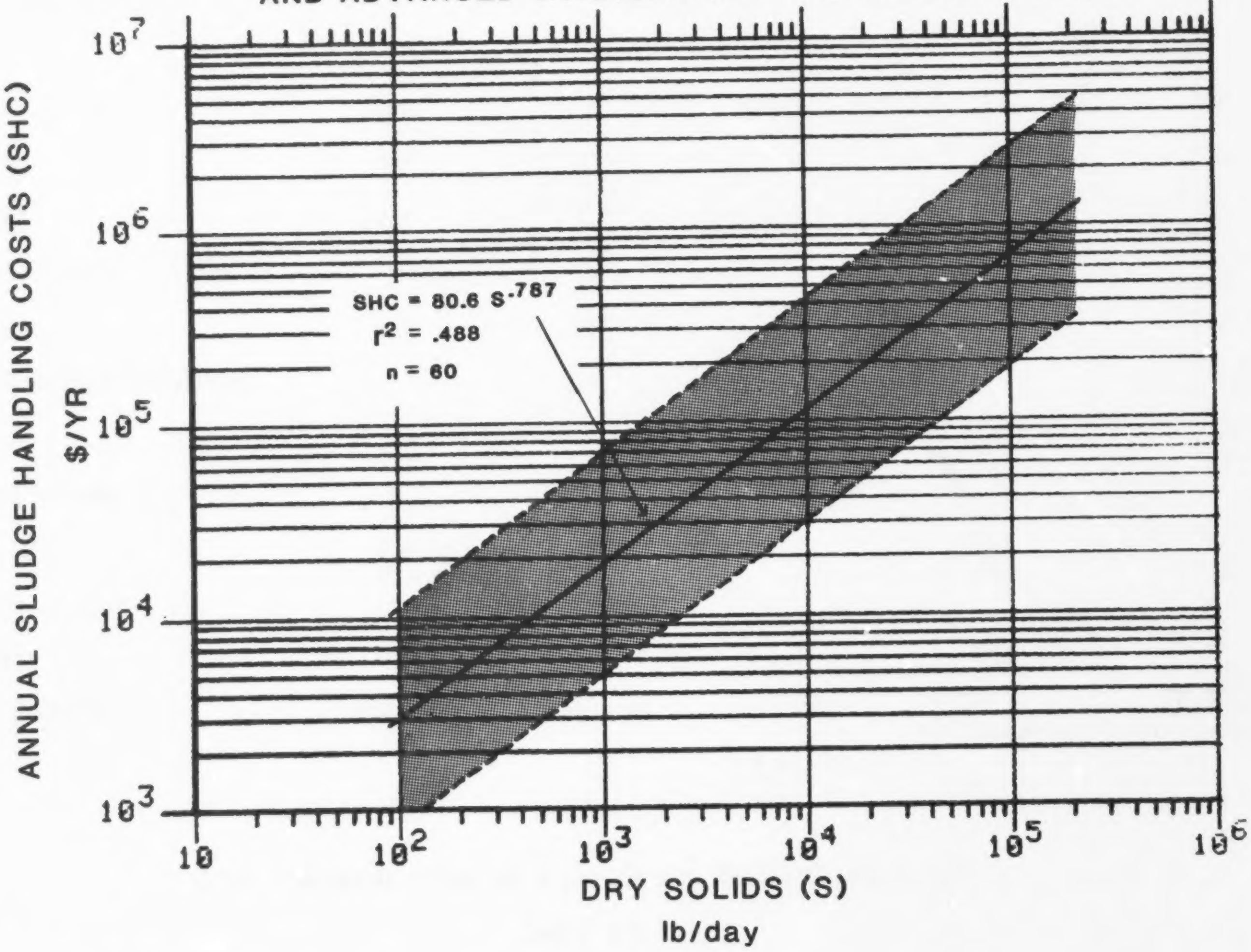


FIGURE 3.28

## TABLE 3.6

## MAJOR COMPONENT COSTS AS A PERCENTAGE OF TOTAL O&M COSTS

| | Components | | | | |
|---|---|---|---|---|---|
| Secondary Treatment | Personnel | Utilities | Chemicals | Equipment & Materials | Constructual & Other |
| This Study | 48% | 26% | 7% | 14% | 12% |
| Trickling Filters: | | | | | |
| EPA | 55% | 28% | 8% | 12% | 7% |
| AMSA | 57% | 13% | 12% | 9% | 9% |
| Activated Sludge: | | | | | |
| EPA | 49% | 26% | 6% | 11% | 7% |
| AMSA | 41% | 26% | 19% | 8% | 7% |
| Advanced Secondary Treatment | | | | | |
| This Study | 48% | 26% | 7% | 7% | 11% |
| Advanced Wastewater Treatment | | | | | |
| This Study | 45% | 30% | 7% | 13% | 10% |
| EPA | 44% | 25% | 11% | 9% | 11% |
| AMSA | 39% | 22% | 22% | 7% | 10% |

Note: All information for EPA and AMSA percentages obtained from Tables 4.8 and 4.9, respectively, of Reference 2. The associated costs were updated to 1st Quarter 1981.

$$\% = \sum_{i}^{n} (c/t \times 100) \times 1/n$$

Where: $n$ = Number of plants having a particular component cost

$c$ = Cost of a given type of component for a particular facility

$t$ = Total O&M costs for the facility

There were differing amounts of data available on each of these component costs. Thus, the percentage of component costs expressed in each type of treatment system will not total to one hundred. In this sense, they are not strictly comparable with the literature reported values or, indeed, one with another. However, such comparisons are useful in determining relative magnitudes of the various components. Table 3.6 demonstrates that the five components chosen for study as described above are, indeed, the major O&M cost components. Furthermore, their ranking and their value agree with earlier reported data (2) on this subject.

Comparison of the percentage of costs represented by each component shows no significant differences among the three levels of treatment studied. For example, personnel costs make up about half of the total annual O&M costs for secondary, advanced secondary, and advanced wastewater treatment facilities. Similar observations can be made with respect to treatment level for the other components of costs. This result is surprising, but may derive from the fact that only biological plants were studied, only a few AWT plants were studied, and all the data were compared on a nationwide basis without regard for cost differences that might arise from geographical location.

## Staffing

As noted in the previous section, personnel costs are a large part of total O&M costs for wastewater control facilities. As little information on this subject is available, treatment plant staffing was made a part of this investigation. The average weekly staff hour report of each facility served as the basis for information on staff size. Unfortunately, this approach does not give a complete picture of personnel needs as many plants use contractors rather than resident staff for such items as laboratory analysis and sludge disposal. Weekly staff hour reports do not reflect this additional manpower, and it is not considered here.

Secondary Treatment Facilities: Figure 3.29 illustrates the data obtained on staff size for 264 secondary treatment facilities with design flows ranging from 0.1 to 120 mgd.

## STAFF SIZE vs DESIGN FLOW

SECONDARY WASTEWATER TREATMENT PLANTS
WITH LITERATURE COMPARISONS

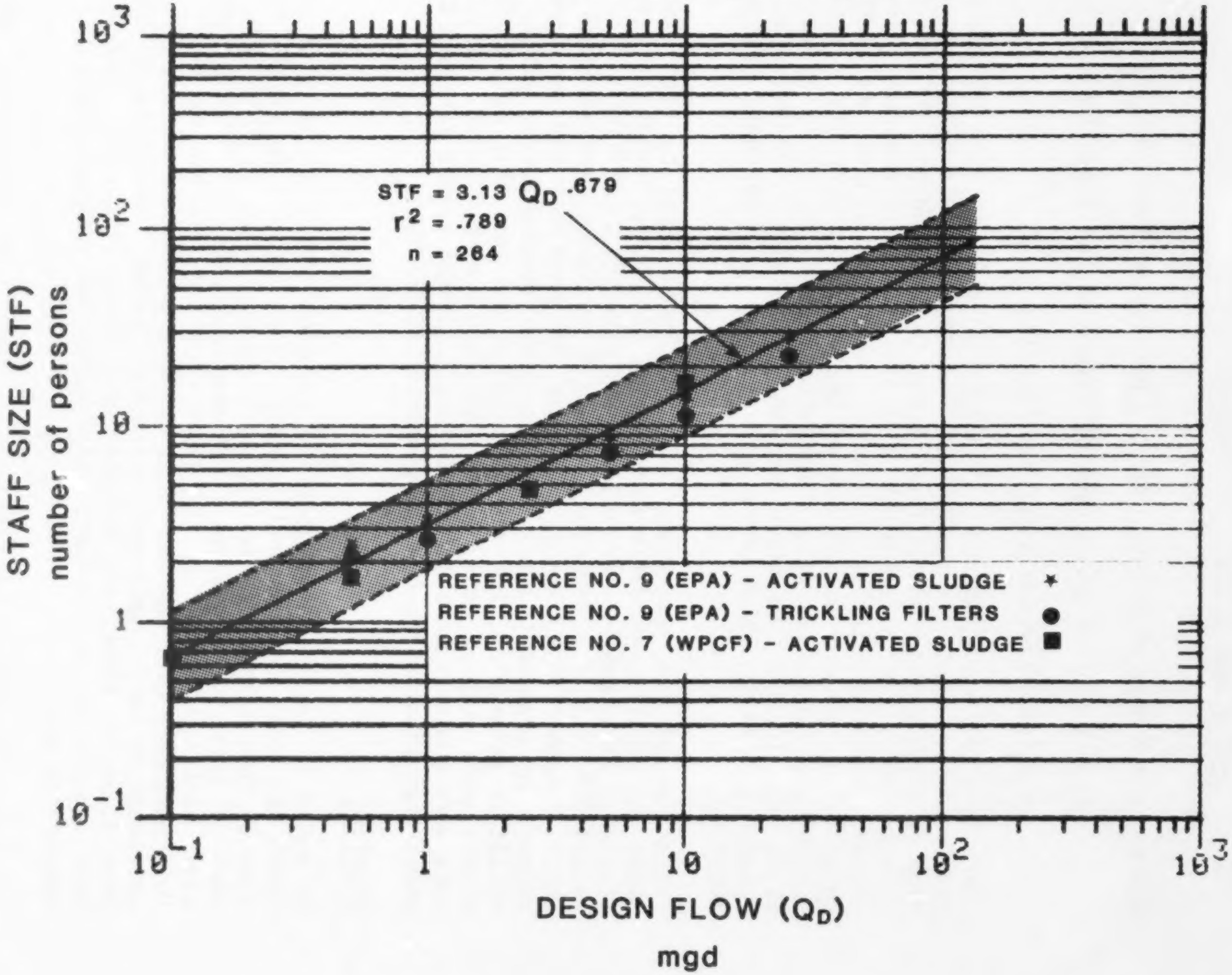


FIGURE 3.29

The regression analysis plotted on Figure 3.29 shows a relatively good relationship between plant size and staff size. Staff size, as a function of plant size, probably should be envisioned as a step function rather than as a curvilinear or linear function. A certain minimum number of staff is required for a plant of a given size. However, this same number of people also might be adequate for plants with considerably larger flows, up to some point, where additional staff would have to be added.

This observation is supported by data obtained from the literature (7, 9) and plotted on Figure 3.29. This literature information fits well with the field information obtained during this investigation. One to three persons, on the average, are required to staff plants ranging in size from 0.1 to more than 1.0 mgd. After that size is reached, additional people must be added.

These data also were used to examine the effect of treatment system type and sludge handling complexity on staff size. Two types of systems were studied--suspended growth and attached growth systems--each having three levels of sludge handling as discussed and described earlier in Table 3.2. This analysis suggested that more complex sludge handling generally results in the need for more staff, although this might depend to some degree on plant size. While this observation seems reasonable, the statistical reliability of the analysis did not permit definitive conclusions on these or other points. Thus, their results are not shown.

Advanced Secondary Treatment Facilities: The data on staff sizes from 95 advanced secondary treatment facilities, with design flows ranging from 0.2 to 100 mgd, produced the regression plot shown in Figure 3.30. Data from the literature (9) are added to this plot for comparative purposes. In general, this plot agrees with observations made earlier about staffing in secondary systems.

The regression line for Figure 3.30 is quite similar to that of Figure 3.29, and they are such that staff sizes for advanced secondary facilities are comparable to those in secondary systems for sizes up to 10 mgd. Above that value staff needs appear to increase more sharply for the advanced secondary plants than for the secondary plants.

Data on staff size versus design flow for advanced secondary plants were segregated and analyzed according to type of sludge handling as described in Table 3.3. Simple sludge handling appeared to be less demanding of staff, but there was no discernible difference in staff needs for plants smaller than 10 mgd. Furthermore, no significant difference in staff requirements was noted between moderate and complex sludge handling. Because of the doubtful significance of these analyses, their results are not presented.

# STAFF SIZE vs DESIGN FLOW

## ADVANCED SECONDARY WASTEWATER TREATMENT PLANTS WITH LITERATURE COMPARISONS

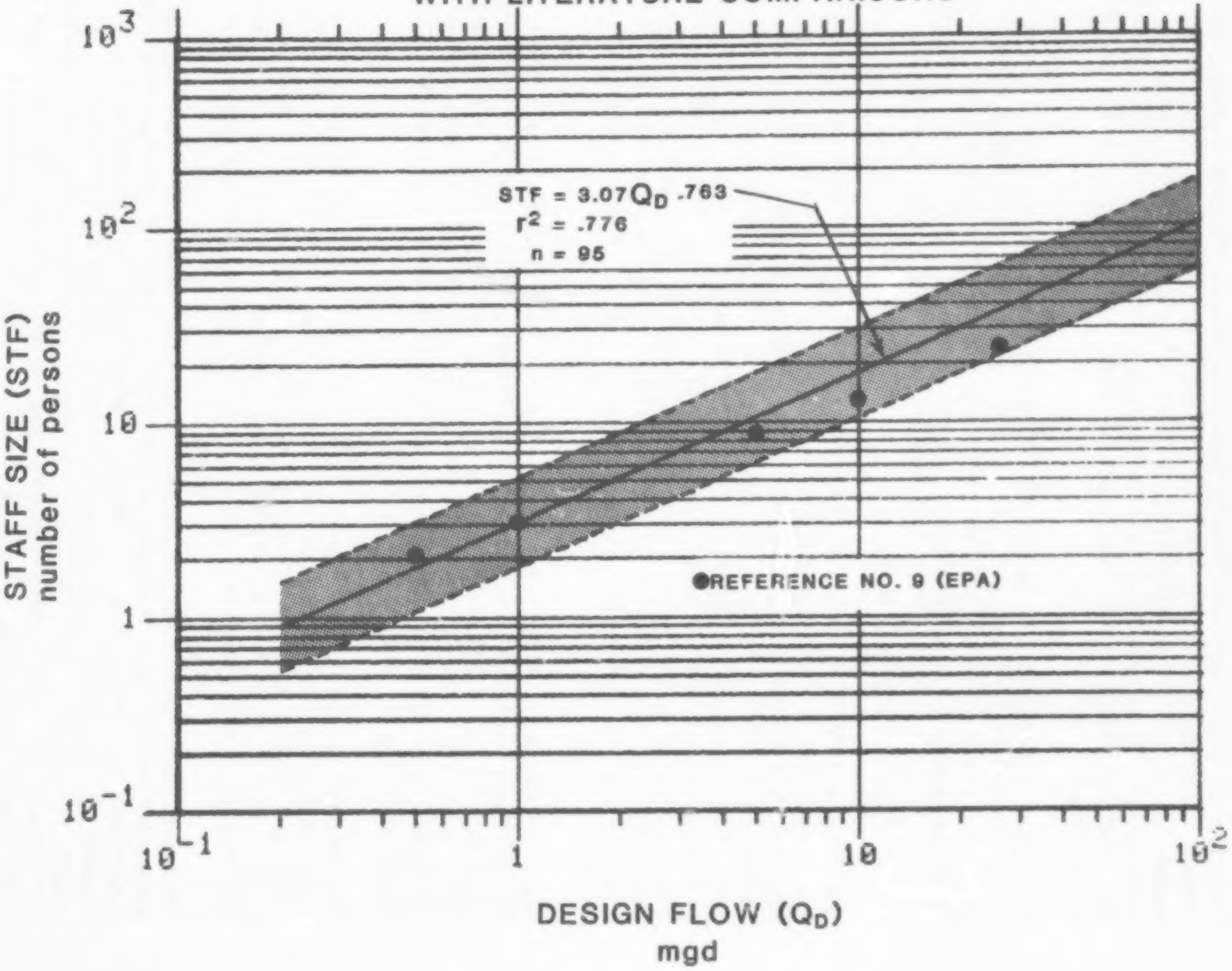


FIGURE 3.30

Advanced Wastewater Treatment Facilities: The plot of staff size versus design flow shown in Figure 3.31 was obtained from data on 39 advanced wastewater treatment facilities having design flow rates up to 70 mgd. As with secondary and advanced secondary systems, data from the literature (9) fit observed data well. Also for sizes up to 10 mgd, advanced wastewater treatment seems to require no more staff than secondary or advanced secondary treatment.

The data on advanced wastewater treatment facilities were segregated and analyzed according to complexity of sludge handling as described earlier in Table 3.4. Simple sludge treatment appeared to be less demanding of staff than moderate or complex handling. Further, the analyses for the latter two cases suggested that for flows smaller than 20 mgd, adding heat treatment to the sludge handling process significantly increases the need for staff. Above the 20 mgd design flow, staff size needs appear to have little relationship to sludge handling complexity. However, the number of plants on which these analyses were based was quite small, and the statistical parameters produced indicated very doubtful relationships. For these reasons, the plots of these analyses are not presented.

Summary and Comparison - Staff Size: Figure 3.32 presents the regression lines produced by the data on staff size versus treatment level for all plants studied. These lines verify that there is little difference in staff needs between the various treatment levels in plants with design flows less than 10 mgd. As design flow increases above 10 mgd, there is a slowly increasing need for more staff in the plants producing higher levels of treatment. More data are needed to see if this relationship holds at design flows above 100 mgd.

All the data on staff size versus design flow were analyzed together and the regression line of this effort is shown in Figure 3.33. This line is quite similar to the regression lines produced from the data on each of the three individual treatment levels and could be used as the general expression for staff size versus design flow.

## Performance

Wastewater treatment plant performance is influenced by many factors. One of the more important is the hydraulic loading--whether or not the facility is overloaded, underloaded, or design loaded with respect to flow. Design loaded facilities are those with average annual hydraulic loadings in the range of 90 to 110 percent of design capacity. Underloaded facilities are those which receive less than 90 percent of their design flow, and overloaded plants are those with actual flows of more than 110 percent of design capacity.

Figures 3.34, 3.35, and 3.36 present information on total annual O&M costs as a function of hydraulic loading for secondary, advanced secondary, and advanced wastewater treatment facilities.

## STAFF SIZE vs DESIGN FLOW

ADVANCED WASTEWATER TREATMENT PLANTS
WITH LITERATURE COMPARISONS

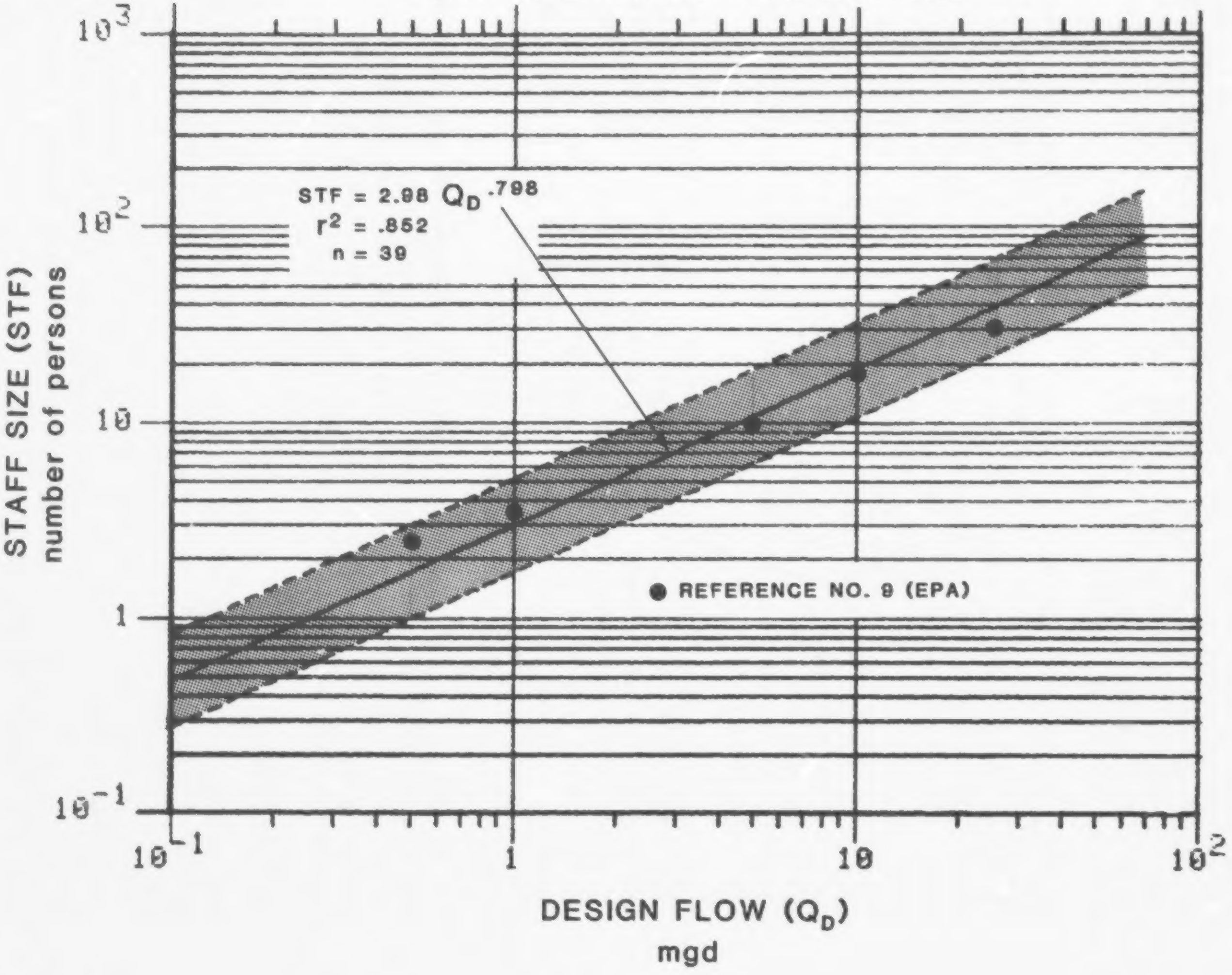


FIGURE 3.31

## STAFF SIZE vs DESIGN FLOW

COMPARISON: TREATMENT LEVELS
SECONDARY, ADVANCED SECONDARY, AND
ADVANCED WASTEWATER TREATMENT PLANTS

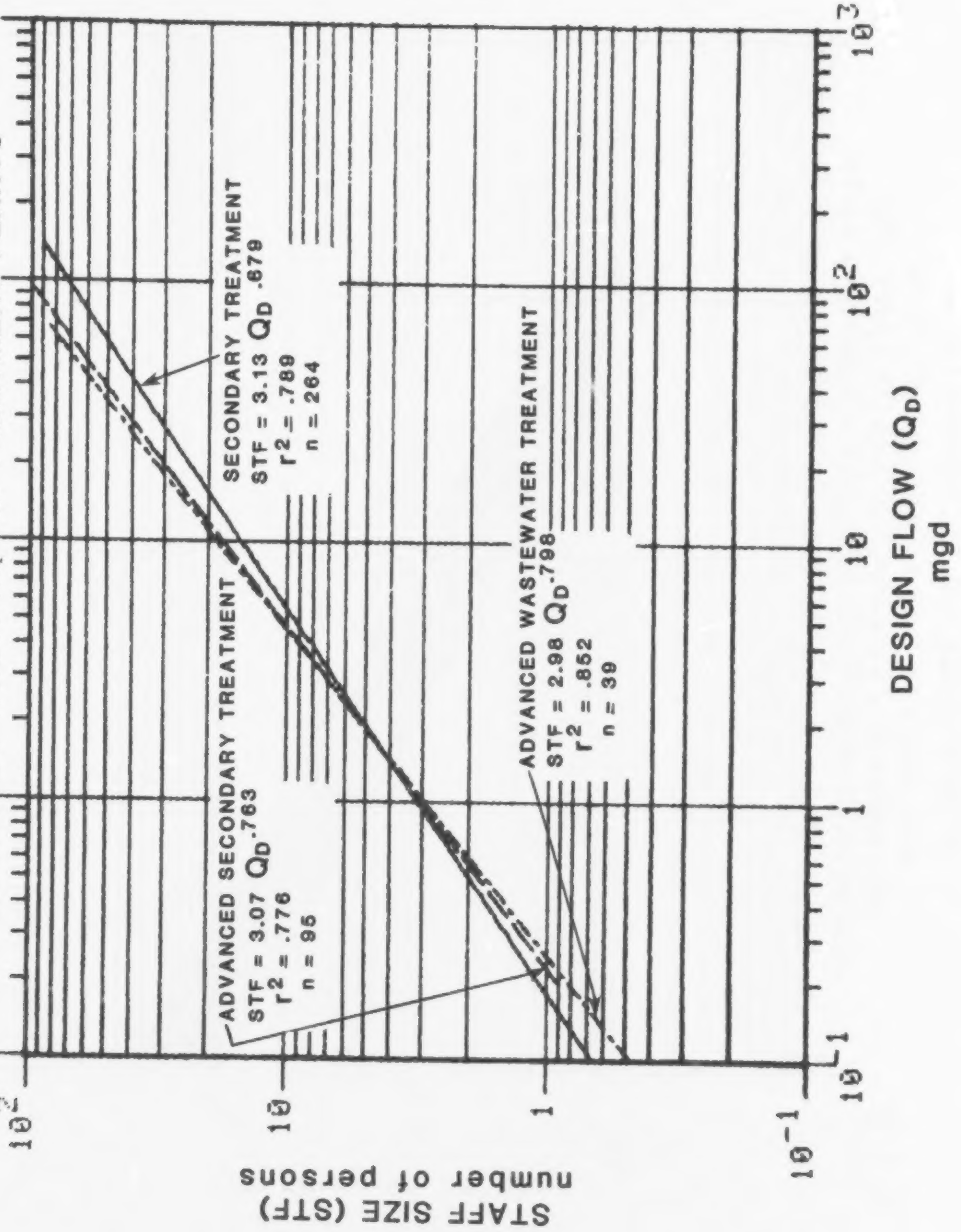


**FIGURE 3.32**

## STAFF SIZE vs DESIGN FLOW

ALL TREATMENT LEVEL COMPOSITE
SECONDARY, ADVANCED SECONDARY, AND
ADVANCED WASTEWATER TREATMENT PLANTS

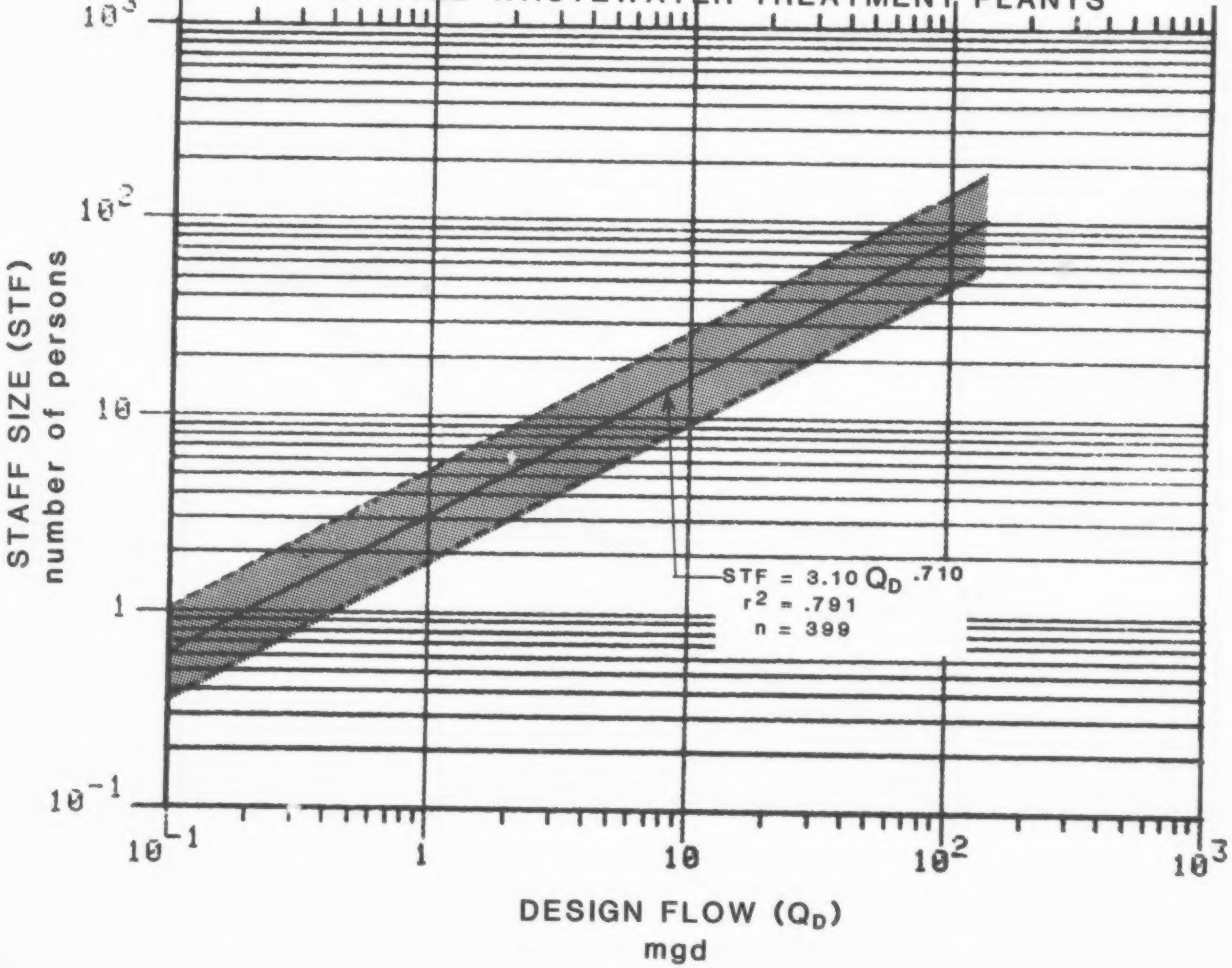


FIGURE 3.33

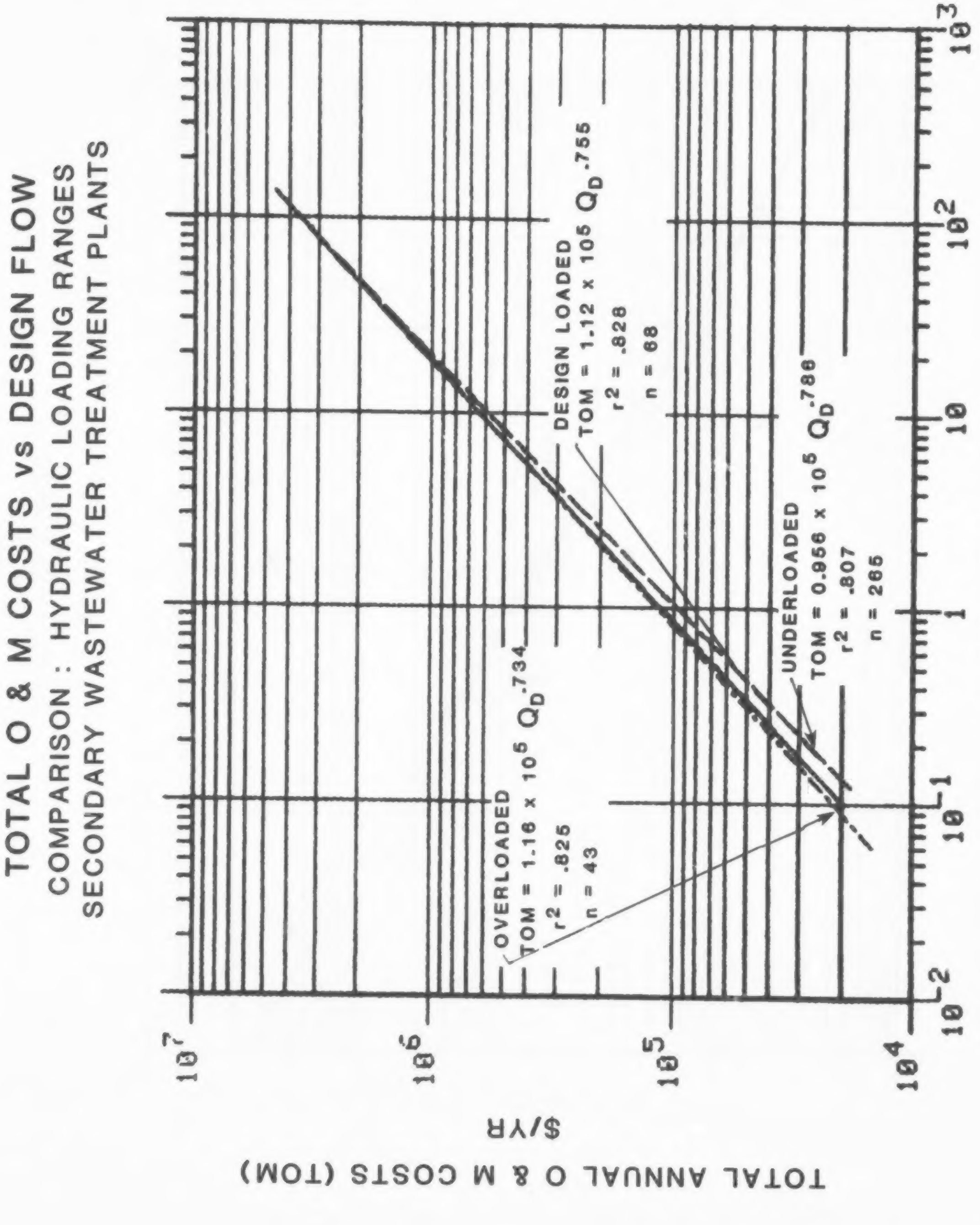

TOTAL O & M COSTS vs DESIGN FLOW
COMPARISON : HYDRAULIC LOADING RANGES
SECONDARY WASTEWATER TREATMENT PLANTS
TOTAL ANNUAL O & M COSTS (TOM)
$/YR
$10^7$
$10^6$
$10^5$
$10^4$
$10^{-2}$
$10^{-1}$
1
10
$10^2$
$10^3$
DESIGN FLOW ($Q_D$)
mgd
OVERLOADED
TOM = $1.16 \times 10^5 Q_D^{.734}$
$r^2$ = .825
n = 43
DESIGN LOADED
TOM = $1.12 \times 10^5 Q_D^{.755}$
$r^2$ = .828
n = 68
UNDERLOADED
TOM = $0.956 \times 10^5 Q_D^{.786}$
$r^2$ = .807
n = 265

FIGURE 3.34

TOTAL O & M COSTS vs DESIGN FLOW
COMPARISON : HYDRAULIC LOADING RANGES
ADVANCED SECONDARY WASTEWATER TREATMENT PLANTS

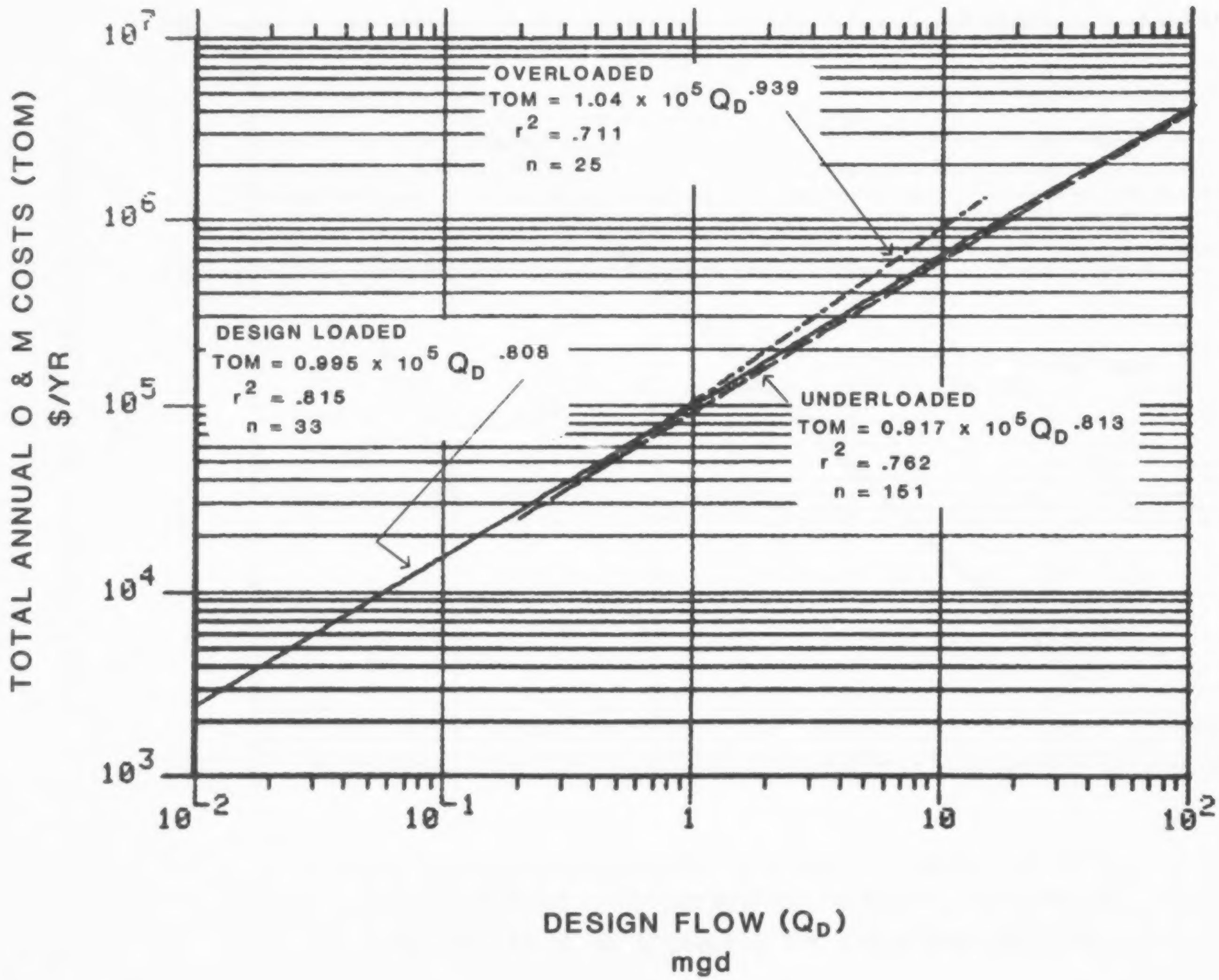


FIGURE 3.35

TOTAL O & M COSTS vs DESIGN FLOW
COMPARISON : HYDRAULIC LOADING RANGES
ADVANCED WASTEWATER TREATMENT PLANTS

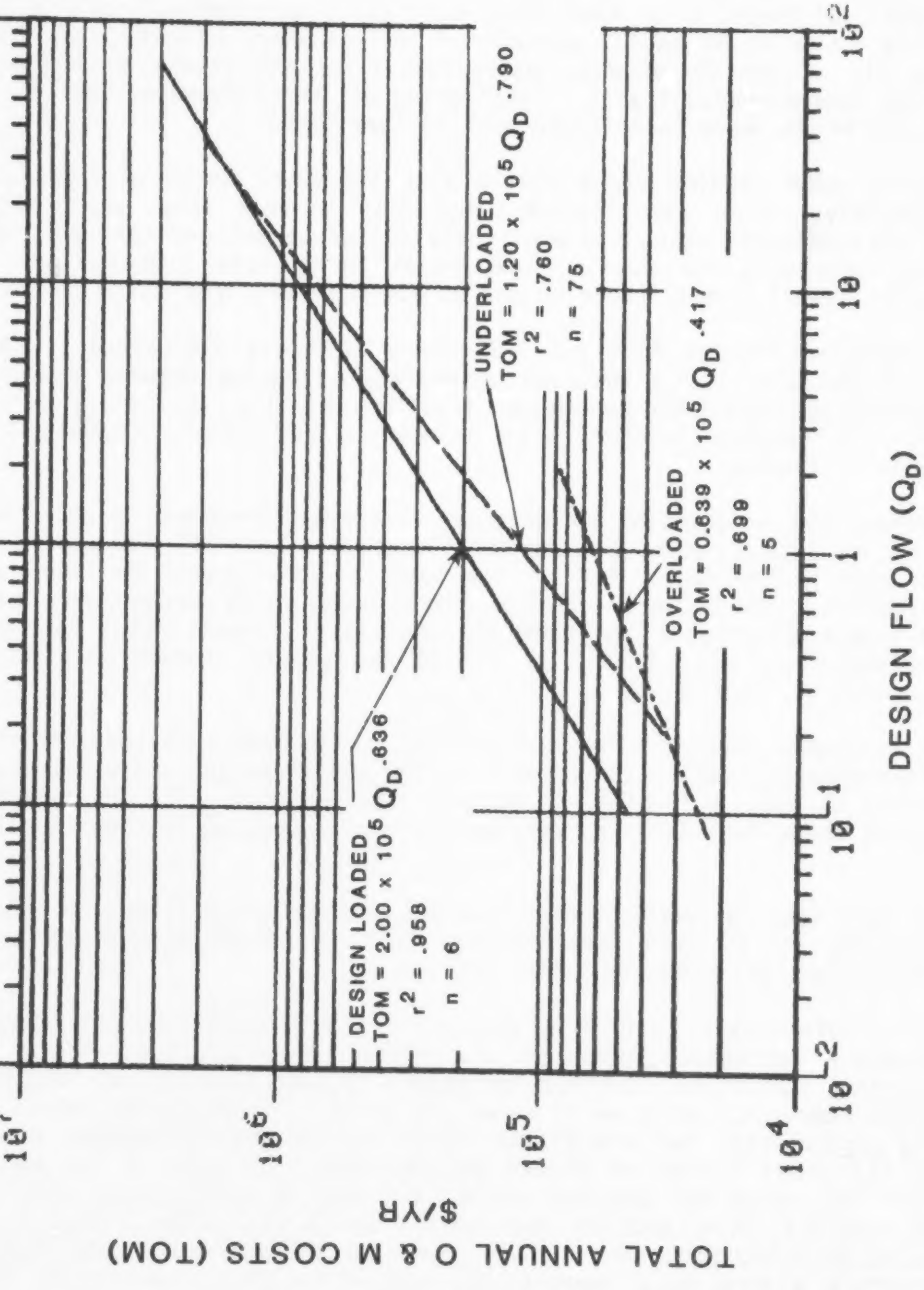


FIGURE 3.36

Most of the plants studied in all three categories are either underloaded or overloaded. The data on these three figures represent 671 plants. Of these, only about 15 percent (107) were hydraulically loaded in the range of 90 to 110 percent of their design capacity. In fact, only six of the 86 advanced wastewater treatment plants studied were design loaded hydraulically. Considering all three types of facilities, a total of 491 were underloaded with 73 overloaded.

Data on each loading range within each treatment level were analyzed separately. Also, each loading range and treatment level was examined for relationships using the applicable full data set and the applicable split data sets for design flows equal to or less than 1.0 mgd and greater than 1.0 mgd. Nothing useful was observed from these analyses.

As shown in Figures 3.34 and 3.35 there is little difference in total annual O&M costs as a function of hydraulic loading between secondary and advanced secondary wastewater treatment plants. In fact, there is little difference in O&M costs between either level, regardless of hydraulic loading.

However, the information on advanced wastewater treatment plants shown in Figure 3.36 presents a different situation. Here O&M costs are less, over most of the range studied, for both the underloaded and overloaded systems as compared to the design loaded ones. This seems unreasonable and probably reflects the need for additional investigation more than anything else, as only six of the 86 AWT plants studied were loaded according to their design.

The data were further screened to select those plants having sufficient information on loading and removal of BOD and suspended solids to permit the use of these parameters in measuring performance. The characterization of these facilities by type and hydraulic loading is shown in Table 3.7.

For each loading range in this sample, average annual five day BOD and suspended solids were computed for both the influent and effluent. These values are shown in Tables 3.8 and 3.9.

It is unfortunate that more data on design loaded AWT and advanced secondary wastewater treatment facilities were not available. For secondary facilities, overloading generally decreases BOD and suspended solids removals, as is well known and further demonstrated here. The data suggest that the same effect occurs with advanced secondary plants, but the small number of plants and the small increase in average effluent BOD noted for the overloaded case make it difficult to determine the relative importance of overloading to these plants. However, it should be noted that the data on suspended solids removal for advanced secondary plants does support the contention that overloading these facilities causes a deterioration in effluent quality.

## TABLE 3.7

## NUMBER OF FACILITIES ACCORDING TO HYDRAULIC LOADING

| Treatment Level | Underloaded | Design Loaded | Overloaded |
|---|---|---|---|
| Secondary | 281 | 40 | 45 |
| Advanced Secondary | 157 | 33 | 25 |
| Advanced Wastewater Treatment | 77 | 6 | 5 |
| Totals | 515 | 108 | 75 |

## TABLE 3.8

## BOD REMOVAL (mg/l) ACCORDING TO HYDRAULIC LOADING

| Treatment Level | Underloaded |  | Design Loaded |  | Overloaded |  |
|---|---|---|---|---|---|---|
|  | Inf. | Eff. | Inf. | Eff. | Inf. | Eff. |
| Secondary | 227 | 21 | 205 | 30 | 178 | 37 |
| Advanced Secondary | 217 | 13 | 174 | 20 | 161 | 22 |
| Advanced Wastewater Treatment | 194 | 9 | 133 | 7 | 105 | 4 |

## TABLE 3.9

## SUSPENDED SOLIDS REMOVAL (mg/l) ACCORDING TO HYDRAULIC LOADING

| Treatment Level | Underloaded |  | Design Loaded |  | Overloaded |  |
|---|---|---|---|---|---|---|
|  | Inf. | Eff. | Inf. | Eff. | Inf. | Eff. |
| Secondary | 209 | 24 | 205 | 29 | 181 | 36 |
| Advanced Secondary | 210 | 16 | 183 | 23 | 171 | 31 |
| Advanced Wastewater Treatment | 196 | 11 | 133 | 11 | 125 | 9 |

Advanced wastewater treatment facilities, on the other hand, seem to produce improved effluent quality--BOD and SS--as they go from underloaded to overloaded. Again, the small number of AWT plants investigated requires that great caution be used in making such a generalization.

Table 3.10 shows that O&M costs per unit volume treated rise for secondary and advanced secondary facilities as they go from underloaded through design flow to overloaded conditions. Why this should be so is not clear. Perhaps more sludge handling costs are encountered at the higher hydraulic loadings, or more operating and/or maintenance problems may be encountered at the higher loading levels.

On the other hand, O&M costs per unit volume treated seem to decline for AWT plants on either side of the design loading. However, the small number of facilities in this data set again makes the drawing of firm conclusions on this point quite risky.

In terms of O&M costs per unit of BOD or suspended solids removed, underloaded facilities should be more costly to operate and maintain than design loaded facilities. This observation is confirmed in general for secondary and advanced secondary plants by the values given in Tables 3.11 and 3.12 which present total O&M costs per pound of BOD and SS removed, respectively. In fact, as shown here, costs per pound of BOD or suspended solids removed increase as the secondary and advanced secondary systems become either underloaded or overloaded. Thus, it appears that design hydraulic loading gives the best return on O&M dollars, as far as BOD and suspended solids removal are concerned, for secondary and advanced secondary plants.

Unfortunately, the data do not show that this is true also for advanced wastewater treatment plants which appear to be more costly to operate at design load than at under or over design. It could be that not enough data are available to permit such generalization for AWT plants. However, it also could be that AWT facilities are being designed with imperfect loading criteria.

## Operating Problems

As part of this study's data collection efforts, plant personnel were questioned on the most difficult problems encountered in operating and maintaining wastewater control facilities. Their responses are tabulated and shown in Table 3.13 according to the frequency of appearance of a particular response. These responses, though far from definitive, are interesting. More than 1,000 responses were recorded. Of these, more than 700 can be interpreted as relating to design/engineering, i.e., the categories listed as fluctuation in loadings, climatological factors, inadequate controls, pilot plant problems, and sludge disposal problems. About 20 percent of the problems reported were equipment

## TABLE 3.10

## TOTAL ANNUAL O&M COSTS/MILLION GALLONS ACCORDING TO HYDRAULIC LOADING

| Treatment Level | Underloaded | Design Loaded | Overloaded |
|---|---|---|---|
| Secondary | $262 | $305 | $317 |
| Advanced Secondary | 251 | 272 | 285 |
| Advanced Wastewater Treatment | 322 | 546 | 175 |

## TABLE 3.11

## TOTAL ANNUAL O&M COSTS/POUND OF BOD REMOVED ACCORDING TO HYDRAULIC LOADING

| Treatment Level | Underloaded | Design Loaded | Overloaded |
|---|---|---|---|
| Secondary | $0.32 | $0.21 | $0.27 |
| Advanced Secondary | 0.35 | 0.21 | 0.30 |
| Advanced Wastewater Treatment | 0.51 | 0.74 | 0.22 |

## TABLE 3.12

## TOTAL ANNUAL O&M COSTS/POUND OF SS REMOVED ACCORDING TO HYDRAULIC LOADING

| Treatment Level | Underloaded | Design Loaded | Overloaded |
|---|---|---|---|
| Secondary | $0.35 | $0.22 | $0.31 |
| Advanced Secondary | 0.37 | 0.23 | 0.30 |
| Advanced Wastewater Treatment | 0.47 | 0.75 | 0.22 |

## TABLE 3.13

## MOST FREQUENTLY REPORTED WASTEWATER TREATMENT O&M PROBLEMS

| Factor | Number of Times Reported |
|---|---|
| Fluctuation in Flows | 210 |
| Design Deficiencies | 184 |
| Equipment Failures | 181 |
| Fluctuation in Loadings | 94 |
| Inadequate Capacity | 97 |
| Understaffing | 89 |
| Climatic Factors | 83 |
| Inadequate Process Controls or Control Plans | 29 |
| Inhibiting Industrial Wastes | 24 |
| Severe Operating Problems Requiring Process Shutdowns or Major Disruptions | 6 |
| Pilot Plant Associated Problems | 2 |
| Sludge Disposal Problems | 2 |
| TOTAL RESPONSES | 1,006 |

failures and about ten percent of the responses are related to inadequate staffing--either in numbers of staff or poorly trained staff.

It follows that almost all of the most commonly observed problems with wastewater treatment plant operation and maintenance are preventable through better design criteria, better design/engineering, and improved operator training and/or staffing.

## Complexity

The Association of Boards of Certification for Operating Personnel in Water and Wastewater Utilities (ABC), with funding from EPA, has developed a standard system for classifying the relative complexity of wastewater facilities (10).

This system provides a means of comparing facilities and is based on such items as population served, design flow, discharge limitations, variations in loading, number and type of treatment processes, and laboratory control. Points are assigned to each of these items and others, and the total number of points are summed to produce a plant rating which reflects the relative complexity of plant operation. Figure 3.37 shows the rating form used for this classification system, and Figure 3.38 offers further explanatory material on it.

These forms and instructions were used to prepare an ABC rating for 671 of the treatment facilities from which data were collected during this study. That rating is presented as part of the listing of plants contained in Appendix A. These ratings also were used to further investigate the relationship between total annual O&M costs, staffing levels, and plant complexity as shown in Figures 3.39 and 3.40. Because the ABC classification reflects more than effluent quality, plants classified for this study as secondary, advanced secondary, and advanced wastewater treatment were found throughout the range of ABC scores.

Figure 3.39 presents total annual O&M costs as a function of the ABC rating score using nationwide data for all levels of treatment. The analysis shown does not provide much confidence regarding the relationship between O&M costs and ABC rating. On the other hand, there is little reason to suspect that a strong relationship exists between the ABC rating and total O&M costs. General plant complexity probably has less effect on total O&M costs than specific factors such as energy use in the plant, use of process chemicals, or method of sludge disposal.

Similar observations apply to Figure 3.40 which shows the regression analysis of ABC rating versus plant staffing size using nationwide data for all treatment levels.

## ABC CLASSIFICATION OF WASTEWATER TREATMENT PLANTS (WWT)

| FACILITY-CLASS | I. | II. | III. | IV. |
|---|---|---|---|---|
| RANGE OF POINTS | 30 and Less | 31-55 | 56-75 | 76 and Greater |

Assign points for every item that applies:

| Item | Points | | |
|---|---|---|---|
| **Size** | | | |
| Maximum population equivalent (P.E.) served, peak day | 1 pt. per 10,000 P.E. or part | | Max. 10 Points |
| Design flow (avg. day) or peak month's flow, (avg. day), whichever is larger | 1 pt. per MGD or part | | Max. 10 Points |
| **Effluent Discharge** | | | |
| Receiving stream (sensitivity) | 0-6* | | |
| Land disposal - evaporation | 2 | | |
| Subsurface disposal | 4 | | |
| **Variation in Raw Wastes (slight to extreme)** | 0-6* | | |
| **Pretreatment** | | | |
| Screening, comminution | 3 | | |
| Grit removal | 3 | | |
| Plant pumping of main flow | 3 | | |
| **Primary Treatment** | | | |
| Primary clarifiers | 5 | | |
| Combined sedimentation/digestion | 5 | | |
| Chemical addition (except chlor., enz.) | 4 | | |
| **Secondary Treatment** | | | |
| Trickling filter w/sec. clarifiers | 10 | | |
| Activated sludge w/sec. clarifiers (including ext. aeration and oxidation ditches) | 15 | | |
| Stabilization ponds without aeration | 5 | | |
| Aerated lagoon | 8 | | |
| **Advanced Waste Treatment** | | | |
| Polishing pond | 2 | | |
| Chemical/physical - without secondary | 15 | | |
| Chemical/physical - following secondary | 10 | | |
| Biological or chemical/biological | 12 | | |
| Ion exchange | 10 | | |
| Reverse osmosis, electrodialysis | 15 | | |
| Chemical recovery, carbon regeneration | 4 | | |
| **Solids Handling** | | | |
| Thickening | 5 | | |
| Anaerobic digestion | 10 | | |
| Aerobic digestion | 6 | | |
| Evaporative sludge drying | 2 | | |
| Mechanical dewatering | 8 | | |
| Solids reduction (incineration, wet oxidation) | 12 | | |
| **Disinfection** | | | |
| Chlorination or comparable | 5 | | |
| On-site generation of disinfectant | 5 | | |
| **Laboratory Control by Plant Personnel** | | | |
| Bacteriological (complexity) | 0-10* | | |
| Chemical/physical (complexity) | 0-10* | | |
| TOTAL** | | | |

***SEE FIGURE 3.38**

**If unique treatment plant conditions distort the point total, the certification board should adjust the facility classification.

**FIGURE 3.37**

## ABC WASTEWATER TREATMENT PLANT CLASSIFICATION
## VARIABLE POINT GUIDE

**Effluent Discharge**

Receiving stream sensitivity .................... 2 - 6*

The key concept is the degree of dilution provided under low flow conditions. Suggested point values are:

"Effluent limited segment" in EPA terminology; secondary treatment is adequate. - 1

More than secondary treatment is required. - 2

"Water quality limited segment" in EPA terminology; stream conditions are very critical (dry run, for example) and a very high degree of treatment is required. - 3

Effluent used in a direct recycle and reuse system. - 6

Variation in Raw Wastes (slight to extreme) .................... 0 - 6*

The key concept is frequency and/or intensity of deviation or excessive variation from normal or typical fluctuations; such deviation can be in terms of strength, toxicity, shock loads, I/I, etc. Suggested point values are:

Variations do not exceed those normally or typically expected. - 0

Recurring deviations or excessive variations of 100 to 200 percent in strength and/or flow. - 2

Recurring deviations or excessive variations of more than 200 percent in strength and/or flow. - 4

Raw wastes subject to toxic waste discharges. - 6

**Laboratory Control by Plant Personnel**

Bacteriological/biological (complexity) .................... 0 - 10*

The key concept is to credit bacti/bio lab work done on-site by plant personnel. Suggested point values are:

Lab work done outside the plant. - 0

Membrane filter procedures. - 3

Use of fermentation tubes or any dilution method; fecal coliform determination. - 5

Biological identification. - 7

Virus studies or similarly complex work conducted on-site. - 10

Chemical/physical (complexity) .................... 0 - 10*

The key concept is to credit chemical/physical lab work done on-site by plant personnel. Suggested point values are:

Lab work done outside the plant. - 0

Push-button or visual methods for simple tests such as pH, settleable solids—up to - 3

Additional procedures such as DO, COD, BOD, gas analysis, titrations, solids, volatile content—up to - 5

More advanced determinations such as specific constituents: nutrients, total oils, phenols, etc.—up to - 7

Highly sophisticated instrumentation such as atomic absorption and gas chromatography. - 10

FIGURE 3.38

TOTAL O & M COSTS vs ABC RATING
ALL TREATMENT LEVEL COMPOSITE
SECONDARY, ADVANCED SECONDARY,
AND ADVANCED WASTEWATER TREATMENT PLANTS

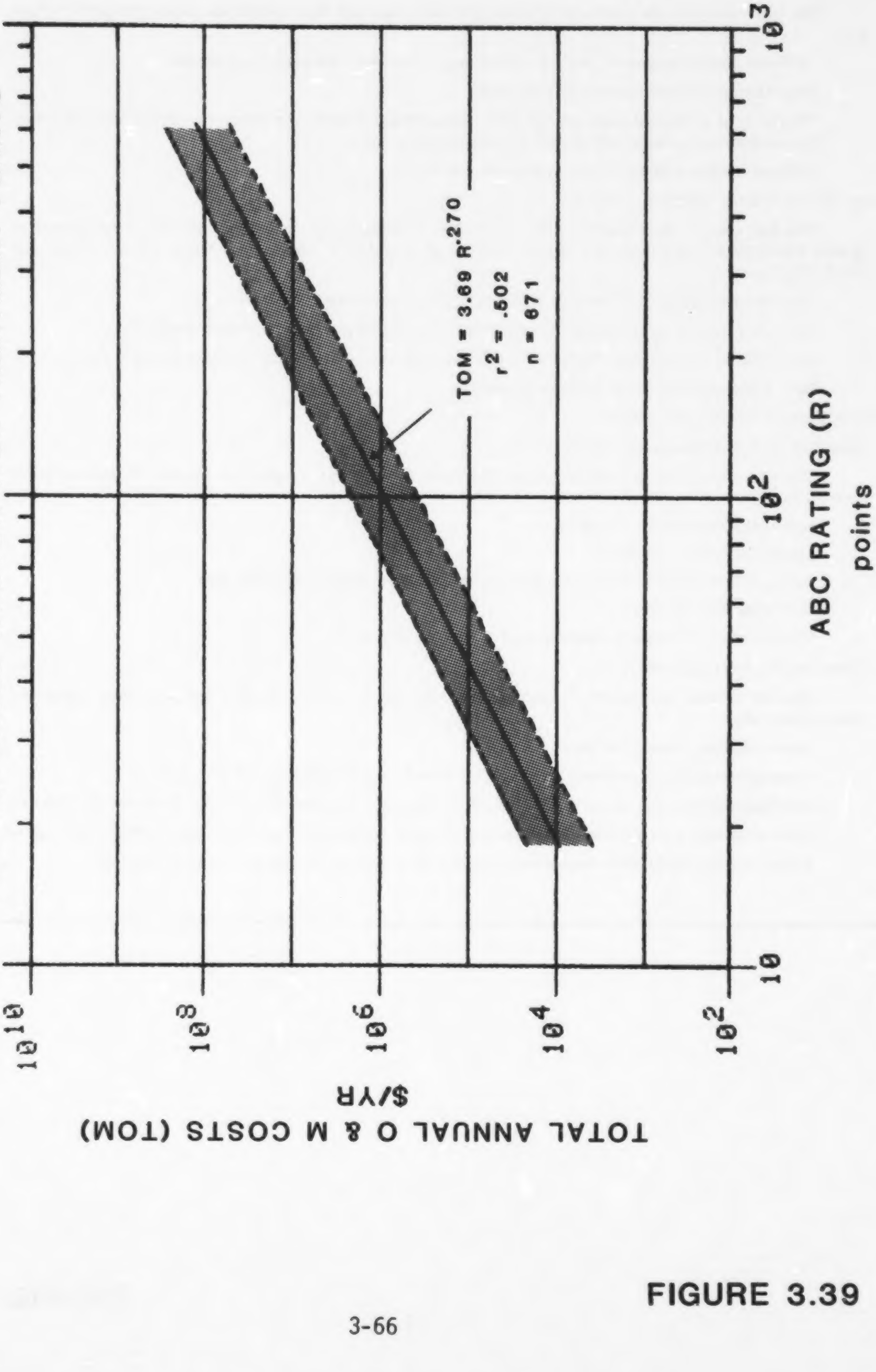


**FIGURE 3.39**

## STAFF SIZE vs ABC RATING
### ALL TREATMENT LEVEL COMPOSITE
### SECONDARY, ADVANCED SECONDARY, AND ADVANCED WASTEWATER TREATMENT PLANTS

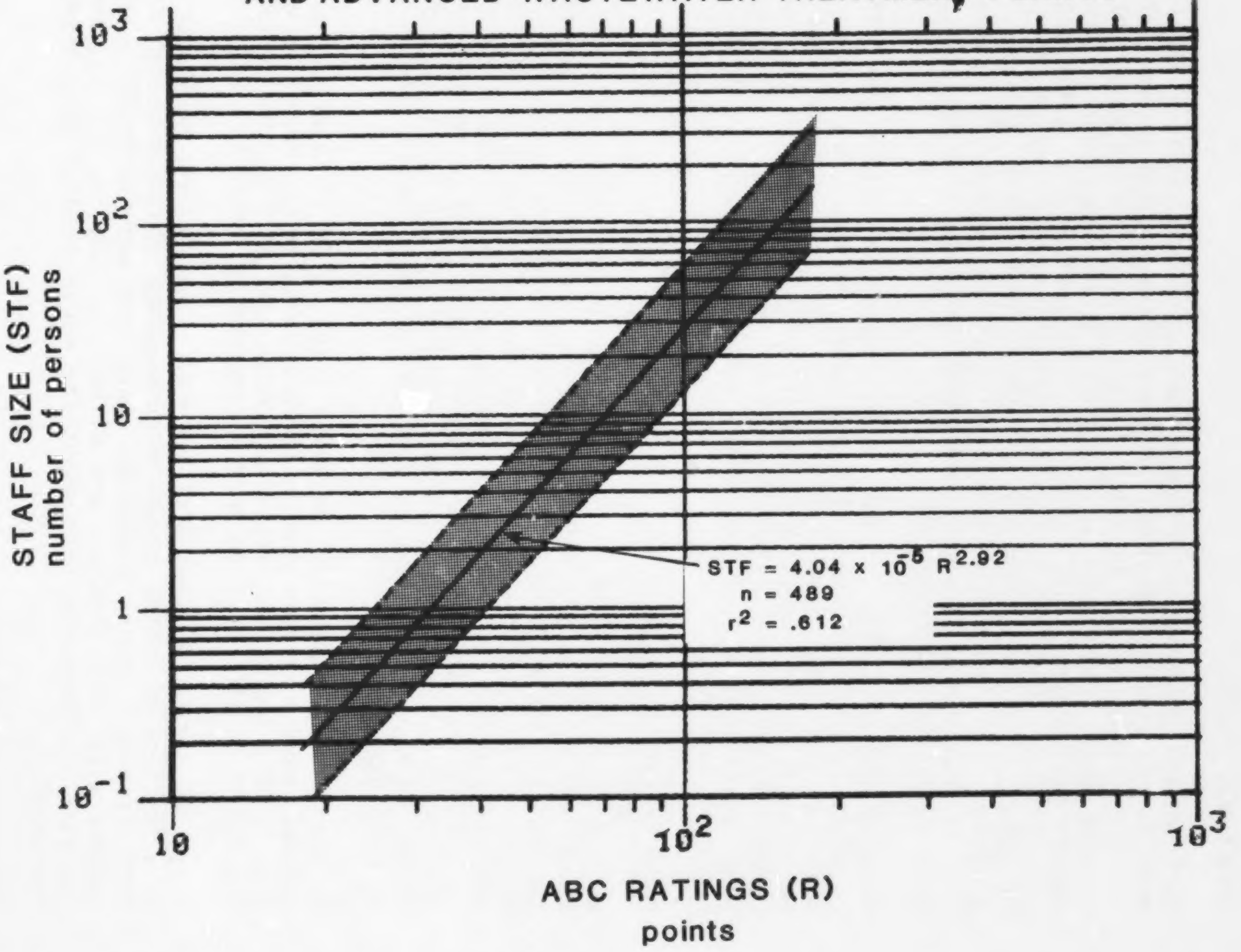


FIGURE 3.40

## CONVEYANCE SYSTEMS

This section presents total annual O&M costs and staffing levels for separate municipal wastewater conveyance systems--those systems intended to carry sanitary and industrial wastes only. More than 480 such systems were investigated. The results are expressed in terms of service population, length of system, and whether the system operates with lift stations or without. Component costs--personnel, power, equipment, materials, and miscellaneous costs--were examined where possible. Only information descriptive of the general national situation is presented. The data were insufficient to produce satisfactory Regional analysis of costs.

Accurate O&M cost data for wastewater conveyance systems are difficult to obtain. This is especially true for the small and medium sized municipalities. Many municipal entities have unified budgets and staff for general public works and separate records of O&M costs for the wastewater conveyance systems frequently are not kept. As a general rule, only total O&M, power costs, personnel costs, and total staff hours are available.

### Total Annual O&M Costs

Service Population: Figures 3.41 and 3.42 present information on total annual O&M costs as a function of service population for systems with and without lift stations. More than 400 conveyance systems are represented on these plots. Comparison of these figures shows that in the smaller systems--less than 2,000 service population--there is no discernible difference in O&M costs between systems with lift stations and those having none. Such systems probably are so small that only a minimal number of lift stations are ever present--causing little impact on total O&M cost.

As the service population increases above 2,000, however, nongravity systems become ever more costly, comparatively, to operate and maintain. This is only logical as increasing system size will require an increasing number of lift stations with corresponding increases in O&M costs.

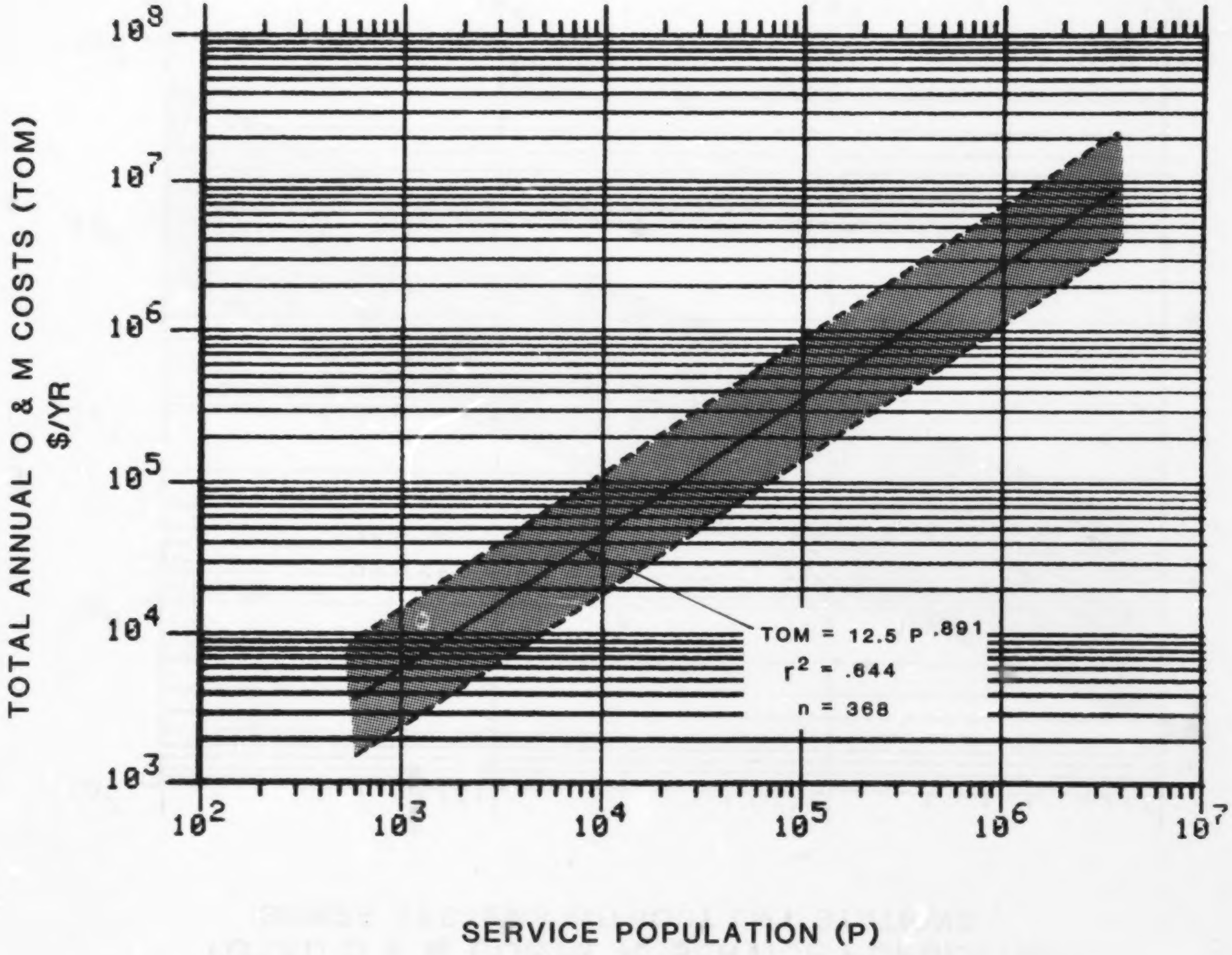
Length of System: Figures 3.43 and 3.44 illustrate the total O&M costs as a function of system length for conveyance systems with and without lift stations. Again, comparison shows that additional O&M costs for systems with lift stations are minimal for the smaller systems but increase continuously throughout the range studied as system size increases.

### Components of O&M Costs

The total annual O&M costs for conveyance systems were divided into four basic components, i.e., personnel, power, equipment and materials, and

## TOTAL O & M COSTS vs SERVICE POPULATION

### SEWER SYSTEMS WITH LIFT STATIONS



$TOM = 12.5\ P^{.891}$

$r^2 = .644$

$n = 368$

FIGURE 3.41

## TOTAL O & M COSTS vs SERVICE POPULATION
### SEWER SYSTEMS WITHOUT LIFT STATIONS

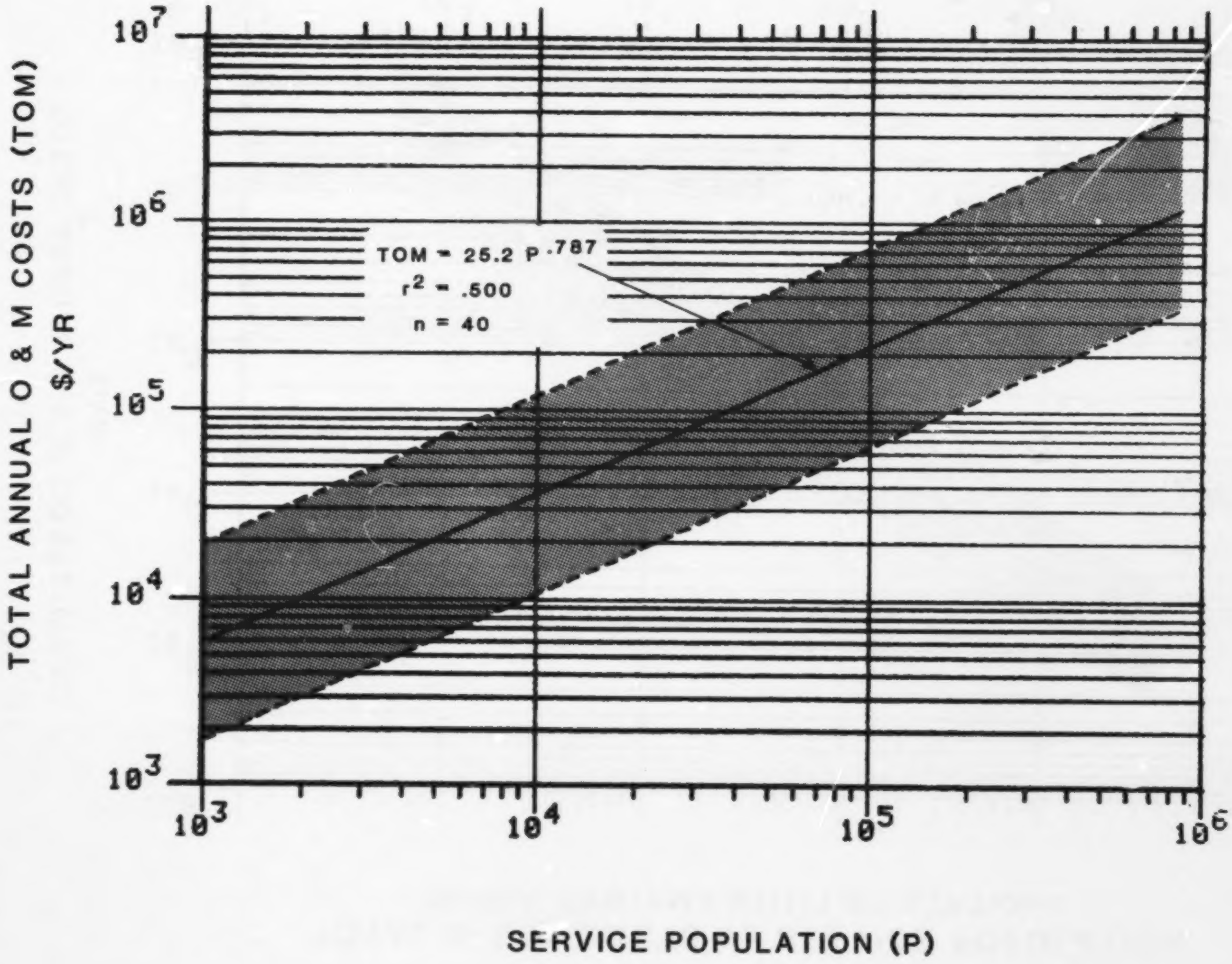
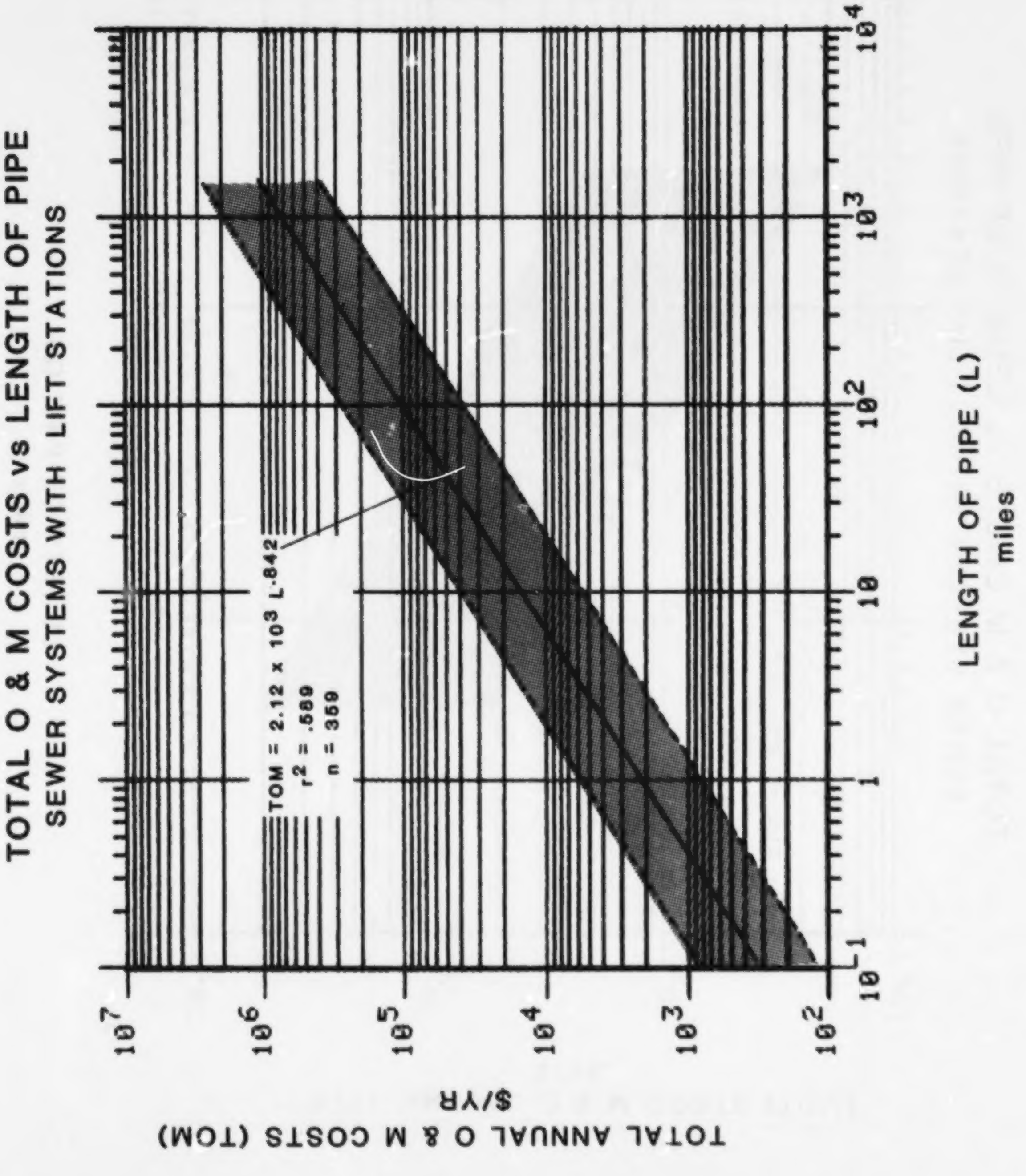


FIGURE 3.42



TOTAL O & M COSTS vs LENGTH OF PIPE

SEWER SYSTEMS WITH LIFT STATIONS

FIGURE 3.43

## TOTAL O & M COSTS vs LENGTH OF PIPE
### SEWER SYSTEMS WITHOUT LIFT STATIONS

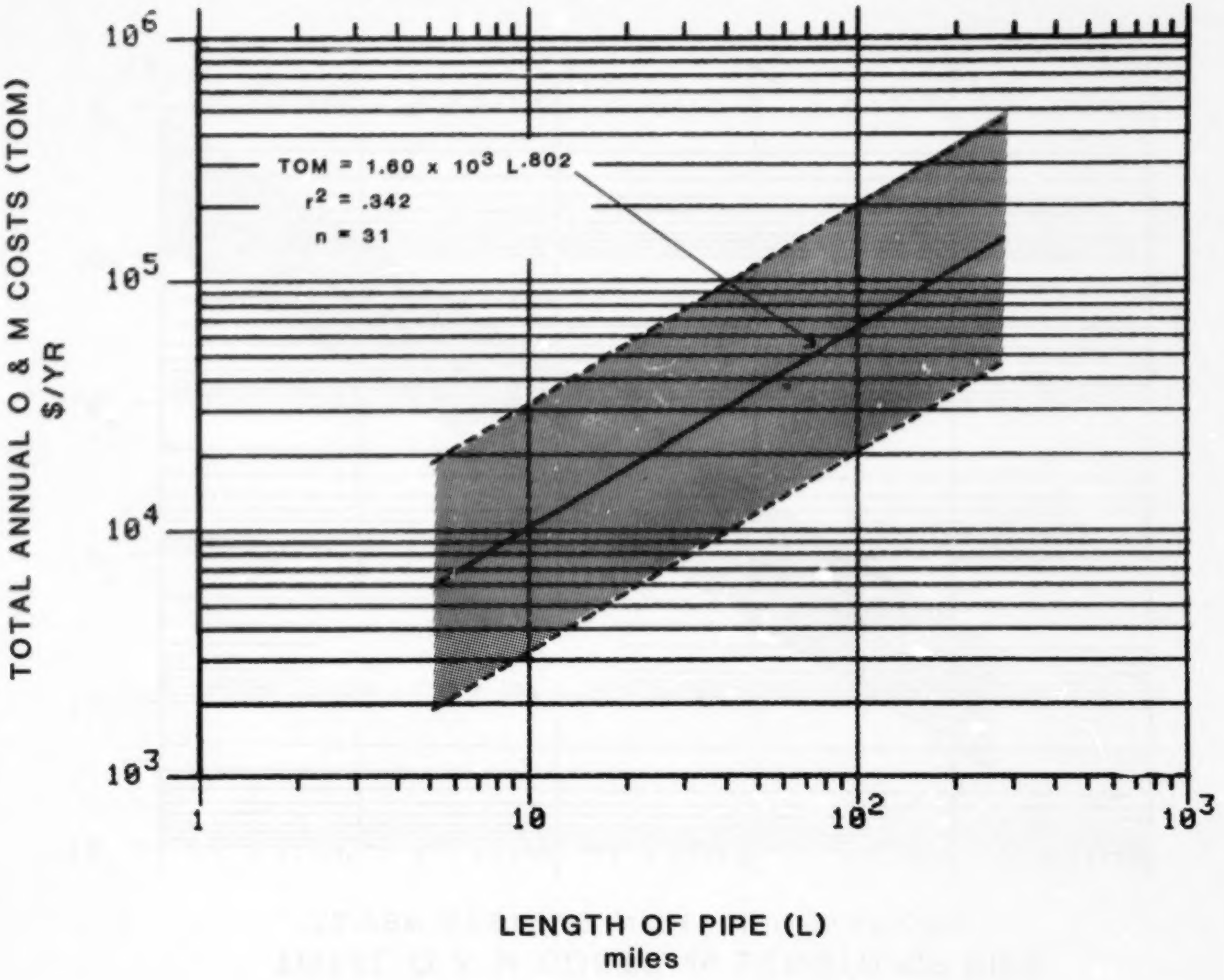


FIGURE 3.44

other. Table 3.14 presents the cost of each of these components expressed as a percentage of the total O&M costs. The component cost percentages were computed from average component costs, as expressed in the following equation:

$$\% = \sum_{i}^{n} (c/t \times 100) \times 1/n$$

Where: n = Number of systems having a particular component cost

c = Cost of a given type of component for a particular system

t = Total O&M cost for the system

The sample size used to calculate this percentage varied, as all components were not available for every system; therefore, the component percentages do not total 100.

The major discernible difference in component costs between gravity and power pumped systems is for power, as would be expected, with the other three components being essentially equal for both types of systems. The largest component of conveyance system O&M costs is for personnel.

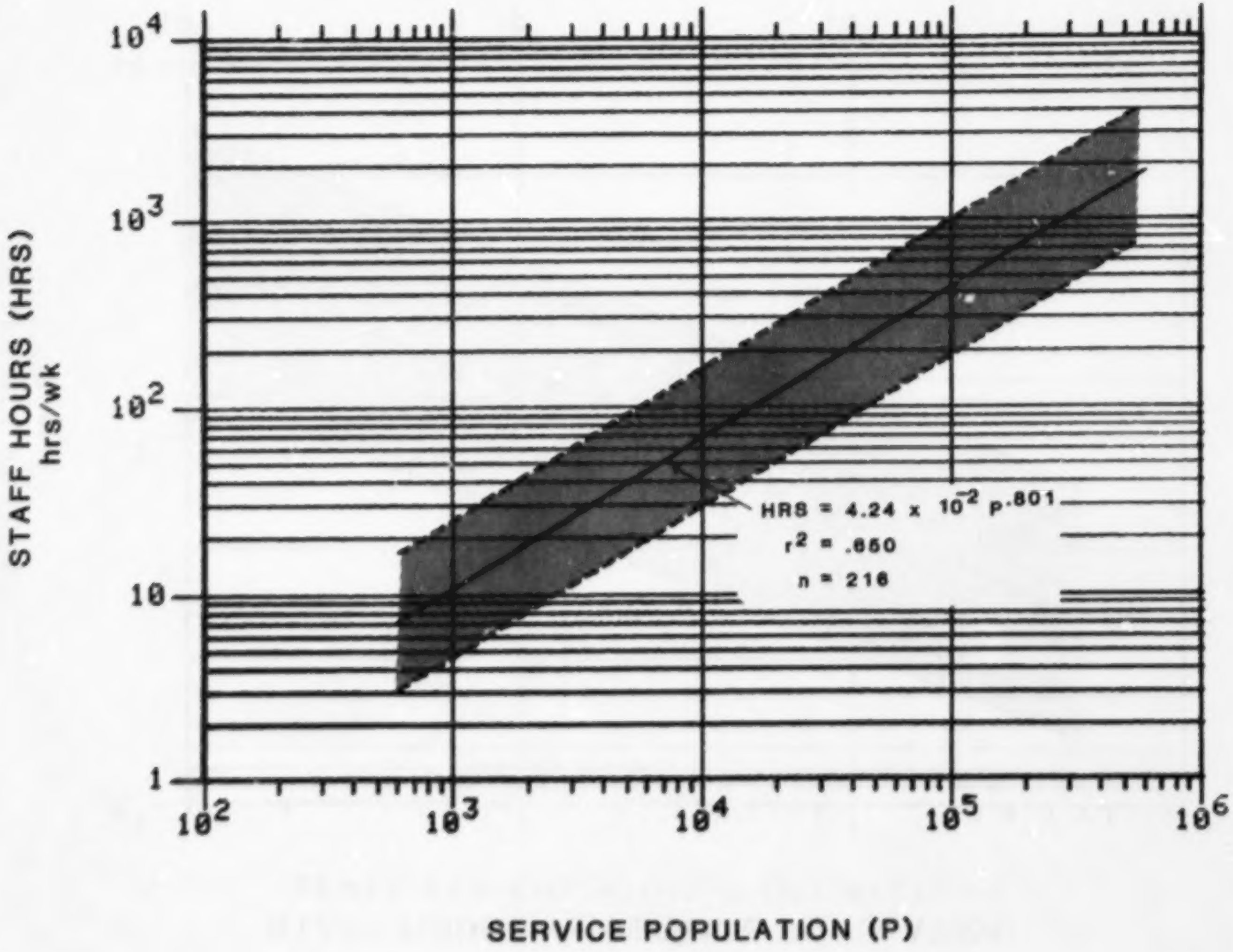
## Staffing

Figures 3.45 and 3.46 show staff hours as a function of the service population for conveyance systems with and without lift stations, respectively. Regrettably, the sample size upon which Figure 3.46 is based is very small, thus the validity of the relationship it illustrates may be suspect. Further, as discussed for treatment systems, staff hours should more logically be considered as a stepwise function of system size.

## TABLE 3.14

## COMPONENT COSTS AS A PERCENTAGE OF TOTAL O&M COSTS FOR CONVEYANCE SYSTEMS

| Components | Systems With Lift Stations | Systems Without Lift Stations |
|---|---|---|
| Personnel | 60% | 63% |
| Power | 18% | 0% |
| Equipment and Materials | 18% | 18% |
| Other | 17% | 25% |



STAFF HOURS vs SERVICE POPULATION
SEWER SYSTEMS WITH LIFT STATIONS

FIGURE 3.45

## STAFF HOURS vs SERVICE POPULATION
SEWER SYSTEMS WITHOUT LIFT STATIONS

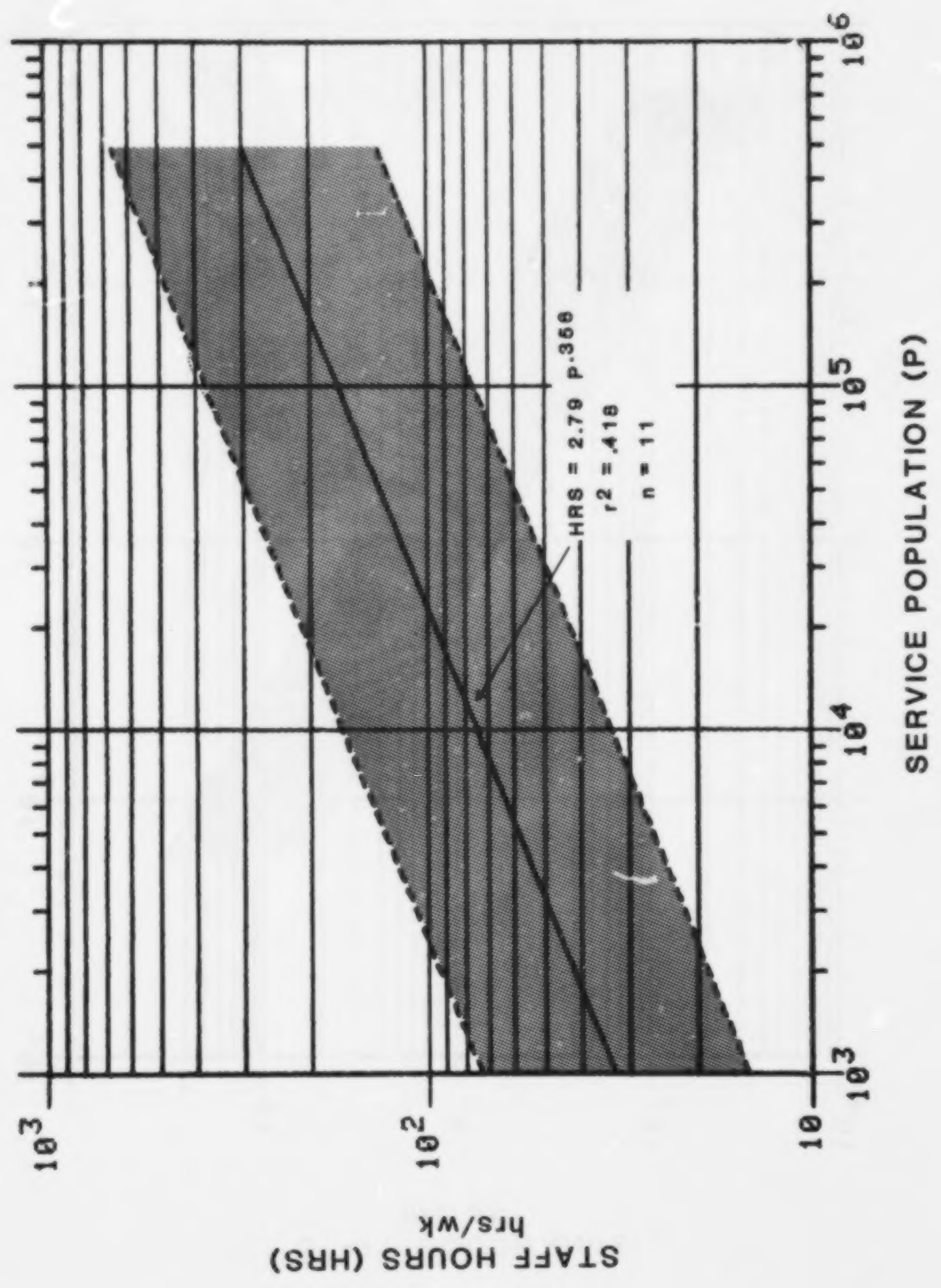


**FIGURE 3.46**

# 4.0 DATA UTILIZATION

## INTRODUCTION

The use of O&M cost relationships developed in previous sections is illustrated here in an example problem. In the example, values are obtained from the figures to provide an estimate of O&M costs for what may be considered an average system. In actual application the cost estimates obtained should be adjusted to reflect any overriding local conditions. The statistical parameters presented with each graph should be useful for this adjustment process.

## EXAMPLE PROBLEM

Midway through the facility planning process for a new treatment plant, local planning officials desire an estimate of O&M costs for a proposed treatment system. The following information is available:

Design Population : 25,000
Existing per Capita Wastewater Flow : 110 gpcd
Design Flow $\frac{(25,000 \times 110)}{1,000,000}$ : 2.75 mgd
Existing Sewer System : 75 Miles of Pipe
2 Lift Stations
Proposed Effluent Limit : 30 mg/l, five day BOD
Proposed Treatment Process : Rotating Biological Contactors
Proposed Sludge Handling : Thickening and Dewatering

The effluent limitation of 30 mg/l BOD indicates secondary treatment as defined earlier. The proposed treatment plant is an attached growth system with moderate sludge handling facilities. The cost data presented previously for secondary treatment plants may be used to estimate total O&M costs for this facility.

Several different figures in this report may be used to obtain an estimate of these O&M costs. Administrative costs are obtained from Figure 3.2. For this example, plant O&M costs are obtained from Figure 3.3 or from Figure 3.26--they yield the same values--which are based on nationwide data. For a specific case, the graph applicable to the appropriate Region (Figures 3.7 through 3.16) could be used.

O&M cost values may be obtained directly from the appropriate graphs and should include the most probable and the highest and lowest probable costs. These upper and lower values illustrate the expected range of costs. Total estimated costs to the community for operation and maintenance of the proposed plant include the administrative costs, as well as plant O&M costs.

Figure 3.6 also may be used to obtain O&M costs for an attached growth/moderate sludge handling plant. This approach yields O&M costs comparable to those obtained from Figure 3.3, with the latter being somewhat more conservative.

An indication of sludge handling costs, using the design flow rate in lieu of an actual flow, is obtained from Figure 3.27. Plant staffing requirements are estimated using Figure 3.29 or Figure 3.33, which yield the same values. Table 4.1 presents the O&M cost and staffing requirements for the example treatment plant obtained from the referenced figures.

Table 4.1 provides annual O&M costs and staff estimates for the plant only. The conveyance system also must be considered. Again, several different figures may be consulted to obtain estimates of conveyance system O&M costs and staffing requirements. For the example, O&M costs based on a service population of 25,000 are obtained from Figure 3.41. For a conveyance system with 75 miles of sewer, Figure 3.43 provides another O&M estimate. The two values obtained this way are different and judgment must be used in selecting the one to be used for planning purposes. In this example, the more conservative estimate is used.

Staffing requirements for the example sewer system are obtained from Figure 3.45. Table 4.2 lists the various conveyance system O&M costs for the example problem.

Table 4.3 summarizes the planning level estimates of O&M costs and staffing requirements for the example system. Debt service or amortization costs would need to be added to these totals to determine the total annual cost to the community.

The earlier section on plant performance should also be considered as part of the planning level O&M cost estimation. Specifically, the plant performance data, presented in terms of efficiency in removing BOD and suspended solids, are important if the influent is projected to be stronger or weaker than average. Data also are presented that reflect the variation in O&M costs as the hydraulic loading increases toward and through the design flow range. Such information might be useful in adjusting average annual O&M estimates over the first several years of the system's operations to more accurately reflect variation in costs resulting from variation in flow or loading during this period.

## COST UPDATING

The O&M costs contained in this report are expressed in 1st Quarter 1981 dollars. All planning level cost estimates, such as those presented in this example, should be updated from 1st Quarter 1981 to the time of their use. EPA Quarterly Indexes of Direct Cost for Operation, Maintenance, and Repair as described earlier should be used for this. These indexes are published quarterly by EPA and also are printed in the Journal Water Pollution Control Federation.

## TABLE 4.1

## EXAMPLE
## WASTEWATER TREATMENT FACILITY ANNUAL O&M ESTIMATES

| Item | Figure No. | Lower Probable Value | Highest Probable Value | Most Probable Value | Planning Estimate |
|---|---|---|---|---|---|
| Administration | 3.2 | $ 6,000 | $ 70,000 | $ 20,000 | $ 20,000 |
| Total O&M - All Secondary Plants | 3.3, 3.26 | $120,000 | $370,000 | $205,000 | $205,000 |
| Total O&M - Attached Growth/ Moderate Sludge Handling | 3.6 | --- | --- | $180,000 | --- |
| O&M - Sludge Handling Treatment | 3.27 | $ 11,000 | $195,000 | $ 56,000 | $ 56,000 |
| Staff Size | 3.29, 3.33 | 4 | 10 | 6 | 6 |

## TABLE 4.2

## EXAMPLE
## CONVEYANCE SYSTEM ANNUAL O&M ESTIMATES

| Item | Figure No. | Lower Probable Value | Highest Probable Value | Most Probable Value | Planning Estimate |
|---|---|---|---|---|---|
| Total O&M - Population | 3.41 | $45,000 | $280,000 | $100,000 | $100,000 |
| Total O&M - Length of Pipe | 3.43 | $30,000 | $200,000 | $ 80,000 | --- |
| Staff | 3.45 | 60 hrs. | 320 hrs. | 150 hrs. | 4 persons |

* (1 Person = 40 hours)

## TABLE 4.3

## EXAMPLE
## TOTAL ANNUAL O&M COST AND STAFFING ESTIMATES

| Cost or Staffing Item | Total O&M Costs | Staffing (Persons) |
|---|---|---|
| Administration | $ 20,000 | --- |
| Total O&M - Plant | 205,000 | 6 |
| Total O&M - Sewer | 100,000 | 4 |
| Totals | $325,000 | 10 |

## Average Per Capita O&M Costs

The treatment facility and conveyance system used in this example has an estimated total annual O&M cost of $325,000. For the assumed population of 25,000 this would result in a $13.00 per capita annual cost for total O&M of the wastewater system.

Assuming an occupancy of three persons in the typical residence, a cost of $13.00 x 3 = $39.00 annually is indicated, or $3.25 per month attributed to O&M for the wastewater control facilities. The costs of debt service and replacement should be added to these costs to estimate the total annual OM&R costs of wastewater conveyance and treatment.

The Construction Grants Program generally provides 75 percent of the funding necessary for the construction of new or improved treatment facilities. Thus, in computing the annual cost of wastewater treatment and conveyance debt service, costs should be based only on the local share of construction costs.

Table 4.4 compares the average annual residential wastewater service charge obtained from this example to those of eight metropolitan cities in the U.S. Charges for these cities were obtained from Inner City Studies prepared for EPA under Contract No. 68-01-5890. The assumption was made that an average residential unit consisted of three persons with a water usage of 330 gallons per day.

Data presented in this report should be used for planning level estimates. For analysis of cost effectiveness as required by 201 facilities plans, the CAPDET method as accepted by EPA or other more comprehensive analyses are necessary.

## TABLE 4.4

## WASTEWATER CHARGES FOR SELECT CITIES

| Description | Total Annual Charge Per Residence |
|---|---|
| Example Problem | $ 39.00* |
| Atlanta, Georgia | 150.00*** |
| Baltimore, Maryland | 80.00 |
| Boston, Massachusetts | 73.00 |
| Denver, Colorado | |
| Flat Rate | 30.00 |
| Metered | 67.00 |
| Los Angeles, California | 41.00 |
| Memphis, Tennessee | 26.00 |
| San Diego, California | 60.00** |
| Seattle, Washington | 109.00*** |

*Includes total O&M costs only. No allowance for debt service, major replacement, or surcharges to commercial and industrial users.

**Flat rate charge.

***Rate for combined sewer system.

Note: All charges are in 1st Quarter 1981 dollars.

# REFERENCES

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2. Analysis of Operations & Maintenance Costs for Municipal Wastewater Treatment Systems, MCD-39, U.S. Environmental Protection Agency, 430/9-77-015, Washington, D.C., February, 1978.

3. 1978 Needs Survey, Conveyance and Treatment of Municipal Wastewater, Summaries of Technical Data, FRD-2, U.S. Environmental Protection Agency, 430/9-79-002, Washington, D.C., February, 1978.

4. Construction Costs for Municipal Wastewater Treatment Plants: 1973-1978, FRD-11, U.S. Environmental Protection Agency, 430/9-80-003, Washington, D.C., April, 1980.

5. Stevens, K. B., Performance and Operation and Maintenance Costs of POTW's in New York State, New York State Department of Environmental Conservation, Albany, N.Y., December 31, 1979.

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9. Estimating Staffing for Municipal Wastewater Treatment Facilities, U.S. Environmental Protection Agency, 68/01-0328, Washington, D.C., March 1973.

10. Administrative Review of the ABC Certification System, Project Report, Grant No. T900589010, U.S. Environmental Protection Agency, Washington, D.C., August, 1977.

# APPENDIX A

## LIST OF WASTEWATER CONTROL FACILITIES IN THE DATA BASE

The following pages contain a listing of the wastewater treatment facilities and conveyance systems which were used to obtain the data base for this report. The listing is presented in two sections. Treatment plants are listed first, followed by conveyance systems. All are listed alphabetically by State and by city within the State. Included for both listings are the facility name and service population. For treatment facilities, the design flow and ABC rating score are shown also. The total length of gravity sewers and force main is given for the conveyance systems.

## TABLE A.1

## LIST OF WASTEWATER TREATMENT PLANTS

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| ALBERTVILLE | ALABAMA | WESTSIDE TP | 9000 | 2.00 | 44 |
| ALBERTVILLE | ALABAMA | EASTSIDE STP | 6000 | 6.00 | 52 |
| FLORENCE | ALABAMA | CYPRESS CK WWTP | 32000 | 10.00 | 62 |
| GADSDEN | ALABAMA | WEST RIVER STP | 46589 | 6.50 | 62 |
| HUNTSVILLE | ALABAMA | HUNTSVILLE WTP 1A | 150000 | 20.00 | 65 |
| HUNTSVILLE | ALABAMA | HUNTSVILLE WTP 1 | 150000 | 10.00 | 70 |
| JASPER | ALABAMA | TOWN CREEK STP | 10000 | 3.05 | 53 |
| MONROVILLE | ALABAMA | DOUBLE BRANCH TP | 1750 | 2.00 | 48 |
| MONROVILLE | ALABAMA | HUDSON BRANCH TP | 3500 | 2.80 | 48 |
| OXFORD | ALABAMA | CHOCCOLOCCO CREEK | 60000 | 8.00 | 67 |
| OZARK | ALABAMA | OZARK WTP A | 7500 | 1.00 | 43 |
| PHENIX CITY | ALABAMA | PHENIX CITY WTP | 26490 | 4.50 | 64 |
| TALLEDEGA | ALABAMA | MAIN STP | 13600 | 4.50 | 53 |
| FAYETTEVILLE | ARKANSAS | FAYETTEVILLE WWTP | 35000 | 10.00 | 78 |
| FORT SMITH | ARKANSAS | P STREET WPCP | 22800 | 10.00 | 0 |
| HARRISON | ARKANSAS | HARRISON WWTP | 7000 | 3.00 | 52 |
| HOT SPRINGS | ARKANSAS | HOT SPRINGS WWTP | 31500 | 12.00 | 103 |
| HUNTSVILLE | ARKANSAS | HUNTSVILLE WWTP | 1300 | 0.28 | 57 |
| PRAIRIE GROVE | ARKANSAS | PRAIRIE GROVE WWTP | 1687 | 0.50 | 57 |
| ROGERS | ARKANSAS | ROGERS WWTP | 12000 | 4.00 | 77 |
| RUSSELVILLE | ARKANSAS | RUSSELVILLE WWTP | 14000 | 4.22 | 59 |
| SPRINGDALE | ARKANSAS | SPRINGDALE WWTP | 25000 | 16.00 | 77 |
| WEST FORK | ARKANSAS | WEST FORK WWTP | 1000 | 0.10 | 55 |
| YELLEVILLE | ARKANSAS | YELLEVILLE WWTP | 1031 | 0.30 | 38 |
| ANDERSON | CALIFORNIA | ANDERSON WPCP | 6500 | 1.00 | 48 |
| BANNING | CALIFORNIA | BANNING STP | 13500 | 1.31 | 43 |
| BARSTOW | CALIFORNIA | BARSTOW STP | 17590 | 5.10 | 50 |
| BURBANK | CALIFORNIA | BURBANK WRP | 83781 | 9.00 | 63 |
| CALABASAS | CALIFORNIA | TAPIA WRF | 45000 | 8.00 | 70 |
| CAMARILLO | CALIFORNIA | CAMARILLO W.REC.PL | 27000 | 4.80 | 83 |
| CARMEL | CALIFORNIA | CARMEL STP | 19950 | 2.40 | 66 |
| CHICO | CALIFORNIA | CHICO WPCP | 28000 | 5.00 | 69 |
| CORONA | CALIFORNIA | CORONA WRF | 58000 | 5.50 | 67 |
| CRESCENT CITY | CALIFORNIA | CRESCENT CITY WPQF | 3000 | 1.89 | 58 |
| DALY CITY | CALIFORNIA | N SAN MATEO C SD | 80000 | 8.00 | 80 |
| EL MONTE | CALIFORNIA | WHITTIER NARROWS T | 140000 | 15.00 | 73 |
| ESCONDIDO | CALIFORNIA | ESCONDIDO STP | 100000 | 11.00 | 82 |
| FREMONT | CALIFORNIA | IRVINGTON WPCP | 66468 | 10.00 | 69 |
| HEALDSBURG | CALIFORNIA | HEALDSBURG TRT. FA | 6000 | 1.00 | 39 |
| INDIO | CALIFORNIA | VALLEY STP | 44765 | 5.00 | 73 |
| LIVERMORE | CALIFORNIA | LIVERMORE WWTP | 50000 | 5.00 | 85 |
| MERCED | CALIFORNIA | MERCED STP | 35000 | 10.00 | 84 |
| MILL VALLEY | CALIFORNIA | MILL VALLEY WWTP | 19500 | 1.50 | 80 |
| MILLBRAE | CALIFORNIA | MILLBRAE WWTP | 21000 | 3.00 | 71 |
| NEWARK | CALIFORNIA | NEWARK WPCP | 93813 | 7.00 | 69 |
| NORTH HIGHLANDS | CALIFORNIA | DIST. NO. 6 TP | 30000 | 3.00 | 32 |
| NOVATO | CALIFORNIA | IGNACIO PLANT | 17400 | 1.20 | 67 |
| NOVATO | CALIFORNIA | NOVATO PLANT | 17400 | 3.00 | 52 |
| OROVILLE | CALIFORNIA | OROVILLE WWTP | 25000 | 5.30 | 61 |
| PINOLE | CALIFORNIA | PINOLE WWTP | 15000 | 2.00 | 83 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| PLACERVILLE | CALIFORNIA | PLACERVILLE WWTP | 6736 | 1.60 | 75 |
| PLEASANTON | CALIFORNIA | PLEASANTON STP | 17000 | 1.70 | 78 |
| POMONA | CALIFORNIA | POMONA STP | 74000 | 10.00 | 63 |
| RED BLUFF | CALIFORNIA | RED BLUFF W RECL P | 9200 | 1.90 | 66 |
| RICHMOND | CALIFORNIA | MUNICIPAL SD #1 | 65000 | 16.00 | 90 |
| RIO DELL | CALIFORNIA | RIO DELL WWTP | 2800 | 0.33 | 58 |
| RIO LINDA | CALIFORNIA | RIO LINDA TP | 5600 | 0.60 | 55 |
| S SAN FRANCISCO | CALIFORNIA | S SAN FRANCISCO ST | 82000 | 13.00 | 90 |
| SAN BERNARDINO | CALIFORNIA | SAN BERNARDINO STP | 172200 | 28.00 | 75 |
| SAN LORENZO | CALIFORNIA | ORO LOMA WWTP | 140000 | 20.00 | 103 |
| SAN RAFAEL | CALIFORNIA | SAN RAFAEL MAIN TP | 32000 | 5.00 | 75 |
| SANTA BARBARA | CALIFORNIA | SANTA BARBARA STP | 85000 | 11.00 | 79 |
| SANTA PAULA | CALIFORNIA | SANTA PAULA WW R F | 18600 | 2.40 | 53 |
| SAUGUS (D. 26) | CALIFORNIA | SAUGUS-NEWHALL WRP | 40500 | 5.00 | 76 |
| STOCKTON | CALIFORNIA | STOCKTON WWCF | 138000 | 67.00 | 149 |
| SUNNYVALE | CALIFORNIA | SUNNYVALE STP | 106400 | 22.50 | 109 |
| THOUSAND OAKS | CALIFORNIA | HILL CANYON STP | 82000 | 10.00 | 93 |
| THOUSAND OAKS | CALIFORNIA | HILL CANYON TP | 69500 | 10.00 | 73 |
| TURLOCK | CALIFORNIA | TURLOCK WQCF | 400000 | 15.50 | 131 |
| UKIAH | CALIFORNIA | UKIAH STP | 14500 | 2.50 | 58 |
| UNION CITY | CALIFORNIA | ALVARADO WPCP | 50006 | 4.50 | 74 |
| VALENCIA | CALIFORNIA | VALENCIA STP | 38500 | 6.00 | 86 |
| VENTURA | CALIFORNIA | VENTURA WATER RENO | 69700 | 14.00 | 101 |
| VENTURA | CALIFORNIA | OAK VIEW STP | 16000 | 3.00 | 71 |
| WEST SACRAMENTO | CALIFORNIA | W SACRAMENT WWTP | 25000 | 5.00 | 70 |
| WHITTIER | CALIFORNIA | SAUGUS STP | 40000 | 5.00 | 64 |
| WHITTIER | CALIFORNIA | LOS COYOTES STP | 190000 | 37.50 | 73 |
| WINDSOR | CALIFORNIA | WINDSOR WWTP | 5200 | 0.75 | 40 |
| ARVADA | COLORADO | CLEAR CREEK VAL. S | 10000 | 2.10 | 68 |
| ASPEN | COLORADO | ASPEN METRO WWTP | 3500 | 2.00 | 53 |
| ASPEN | COLORADO | ASPEN WWTP | 1430 | 0.50 | 50 |
| AVON | COLORADO | AVON STP | 15000 | 2.00 | 46 |
| BERTHOUD | COLORADO | BERTHOUD STP | 3100 | 0.90 | 40 |
| BOULDER | COLORADO | 75TH ST WWTP | 57904 | 15.60 | 70 |
| BRIGHTON | COLORADO | BRIGHTON WPCP | 16000 | 1.80 | 51 |
| CANON CITY | COLORADO | CANON CITY METRO T | 10000 | 2.50 | 46 |
| CARBONDALE | COLORADO | CARBONDALE WWTP | 2800 | 0.50 | 46 |
| COLORADO SPRING | COLORADO | COLORADO SPRINGS T | 220000 | 30.00 | 105 |
| COMMERCE CITY | COLORADO | SOUTH ADAMS CO STP | 27000 | 3.00 | 40 |
| CORTEZ | COLORADO | CORTEZ NORTH WWTP | 1875 | 0.42 | 41 |
| DENVER | COLORADO | S. LAKEWOOD STP | 17000 | 2.30 | 46 |
| DILLON | COLORADO | BLUE RIVER STP | 4000 | 2.00 | 60 |
| DURANGO | COLORADO | DURANGO STP | 12000 | 2.50 | 55 |
| EATON | COLORADO | EATON WWTP | 2200 | 0.34 | 40 |
| ENGLEWOOD | COLORADO | ENGLEWOOD/LITTLETO | 180000 | 20.00 | 82 |
| ESTES PARK | COLORADO | UPPER THOMPSON SD | 12000 | 1.50 | 87 |
| ESTES PARK | COLORADO | ESTES PARK STP | 2500 | 0.80 | 43 |
| EVERGREEN | COLORADO | EVERGREEN WWTP | 4550 | 1.00 | 65 |
| FRISCO | COLORADO | FRISCO SD WWTP | 2000 | 0.75 | 53 |
| FT. COLLINS | COLORADO | WWTP #2 | 35000 | 4.80 | 63 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| FT. COLLINS | COLORADO | WWTP #1 | 35000 | 4.60 | 59 |
| GLENWOOD SPRING | COLORADO | GLENWOOD SPRINGS | 7350 | 1.20 | 48 |
| IDAHO SPRINGS | COLORADO | IDAHO SPRINGS WWTP | 3000 | 0.35 | 50 |
| LAFAYETTE | COLORADO | LAFAYETTE STP | 9500 | 0.36 | 48 |
| LONGMONT | COLORADO | LONGMONT STP | 45000 | 8.30 | 97 |
| LONGMONT | COLORADO | LONGMONT STP | 37000 | 5.30 | 66 |
| LOUISVILLE | COLORADO | LOUISVILLE STP | 5700 | 1.00 | 41 |
| LOVELAND | COLORADO | LOVELAND WWTP#1 | 35000 | 7.70 | 83 |
| MEEKER | COLORADO | MEEKER SD | 2350 | 0.40 | 57 |
| MONTROSE | COLORADO | MONTROSE WWTP | 8500 | 0.85 | 54 |
| MORRISON | COLORADO | MORRISON STP | 413 | 0.07 | 27 |
| PUEBLO | COLORADO | PUEBLO STP | 104000 | 17.00 | 75 |
| SALIDA | COLORADO | SALIDA STP | 6000 | 0.80 | 50 |
| TRINIDAD | COLORADO | TRINIDAD STP | 10000 | 1.80 | 51 |
| WESTMINSTER | COLORADO | BIG DRY CK STP | 10000 | 1.40 | 74 |
| ENFIELD | CONNECTICUT | ENFIELD WPCP | 48000 | 10.00 | 72 |
| FAIRFIELD | CONNECTICUT | FAIRFIELD WPCF | 46000 | 9.00 | 79 |
| GROTON | CONNECTICUT | CITY OF GROTON PAF | 15000 | 3.10 | 68 |
| LITCHFIELD | CONNECTICUT | TWN OF LITCHFIELD | 5700 | 0.80 | 57 |
| MANCHESTER | CONNECTICUT | MANCHESTER STP | 46600 | 6.75 | 78 |
| NAUGATUK | CONNECTICUT | NAUGATUK TRMT CO. | 30000 | 10.30 | 71 |
| SALISBURY | CONNECTICUT | TWN SALISBURY WWTF | 2400 | 0.68 | 45 |
| SEYMOUR | CONNECTICUT | SEYMOUR WPCF | 10000 | 1.00 | 68 |
| STAMFORD | CONNECTICUT | STAMFORD WPCF | 90000 | 20.00 | 104 |
| TORRINGTON | CONNECTICUT | TORRINGTON WPCF | 28500 | 7.00 | 88 |
| WAREHOUSE PT | CONNECTICUT | EAST WINDSOR WPCA | 2400 | 0.80 | 75 |
| WEST HAVEN | CONNECTICUT | WEST HAVEN WPCP | 52000 | 12.50 | 91 |
| WILLIMANTIC | CONNECTICUT | WILLIMANTIC WWTP | 20000 | 5.50 | 70 |
| DELAWARE CITY | DELAWARE | DELAWARE CITY WWTP | 2600 | 0.50 | 62 |
| GEORGETOWN | DELAWARE | GEORGETOWN STP | 3000 | 0.27 | 34 |
| HARRINGTON | DELAWARE | HARRINGTON STP | 2500 | 0.60 | 40 |
| MIDDLETOWN | DELAWARE | MIDDLETOWN STP | 2900 | 0.40 | 53 |
| BOCA RATON | FLORIDA | BOCA RATON STP | 35000 | 10.00 | 56 |
| COCOA | FLORIDA | COCOA STP | 15025 | 2.00 | 55 |
| DAYTONA | FLORIDA | BETHUNE STP | 100000 | 10.00 | 70 |
| FT.PIERCE | FLORIDA | FT.PIERCE CITY WWT | 33000 | 5.00 | 61 |
| GOULDS | FLORIDA | GOULDS STP | 20000 | 6.00 | 65 |
| HOLLY HILL | FLORIDA | HOLLY HILL STP | 10000 | 1.30 | 55 |
| HOMESTEAD | FLORIDA | HOMESTEAD STP | 10000 | 2.30 | 74 |
| JACKSON. BEACH | FLORIDA | JACKSON. BEACH STP | 17700 | 3.00 | 42 |
| KISSIMMEE | FLORIDA | KISSIMMEE 192 STP | 12000 | 1.70 | 57 |
| KISSIMMEE | FLORIDA | KISS.MILL SLOUGH W | 5000 | 1.00 | 44 |
| MELBOURNE | FLORIDA | GRANT ST STP | 21225 | 2.50 | 65 |
| MIAMI | FLORIDA | VIRGINIA KEYS STP | 400000 | 70.00 | 65 |
| PENSACOLA | FLORIDA | MONTCLAIR PLANT ST | 8586 | 1.10 | 54 |
| ST. AUGUSTINE | FLORIDA | ST. AUGUSTINE PL.# | 15700 | 3.00 | 53 |
| ST.PETERSBURG | FLORIDA | NORTHEAST STP #2 | 44700 | 8.00 | 75 |
| TALLAHASSEE | FLORIDA | SOUTHWEST STP | 80000 | 8.80 | 93 |
| TARPON SPRINGS | FLORIDA | TARPON SPRINGS STP | 15000 | 1.30 | 59 |
| TITUSVILLE | FLORIDA | SOUTH STP | 10000 | 2.00 | 39 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| AMERICUS | GEORGIA | MUCKALEE CREEK WPC | 13500 | 2.00 | 53 |
| ATHENS | GEORGIA | NORTH OCONEE WPC 1 | 0 | 5.00 | 70 |
| ATHENS | GEORGIA | NORTH OCONEE WPC 2 | 0 | 2.00 | 62 |
| BRUNSWICK | GEORGIA | BRUNSWICK WPCP | 35000 | 10.00 | 71 |
| CARROLLTON | GEORGIA | CARROLLTON WWTP | 0 | 5.00 | 69 |
| CHICKAMAUGA | GEORGIA | CHICKAMAUGA WW PLT | 760 | 5.20 | 47 |
| COLLEGE PARK | GEORGIA | FLINT RIVER WPC | 0 | 6.00 | 73 |
| COLLEGE PARK | GEORGIA | SOUTHEAST WPC PLAN | 3138 | 1.20 | 47 |
| COVINGTON | GEORGIA | COVINGTON WWTP | 10000 | 3.00 | 43 |
| DOUGLAS | GEORGIA | DOUGLAS WPCP SE | 10500 | 5.00 | 46 |
| LAGRANGE | GEORGIA | BLUE JOHN MUNICIPA | 15000 | 3.50 | 56 |
| LILBURN | GEORGIA | JACKSON CREEK WPC | 0 | 2.40 | 61 |
| ST. SIMONS ISLA | GEORGIA | ST. SIMONS ISLAND | 8700 | 1.00 | 56 |
| SUMMERVILLE | GEORGIA | SUMMERVILLE WWTP | 1363 | 2.00 | 50 |
| THOMASVILLE | GEORGIA | THOMASVILLE WPCP | 19095 | 4.00 | 57 |
| ABERDEEN | IDAHO | ABERDEEN STP | 1640 | 0.60 | 54 |
| BOISE | IDAHO | BOISE WEST STP | 26830 | 5.00 | 55 |
| BOISE | IDAHO | LANDER STREET STP | 78880 | 15.00 | 90 |
| IDAHO FALLS | IDAHO | IDAHO FALLS STP | 50000 | 14.00 | 83 |
| JEROME | IDAHO | JEROME WWTP | 6800 | 0.72 | 57 |
| MERIDIAN | IDAHO | MERIDIAN STP | 6654 | 2.82 | 65 |
| SODA SPRINGS | IDAHO | SODA SPRINGS WWTP | 4051 | 1.50 | 63 |
| TWIN FALLS | IDAHO | TWIN FALLS STP | 25000 | 8.00 | 88 |
| MILLEDGEVILLE | ILLINOIS | MILLEDGEVILLE STP | 6500 | 0.50 | 58 |
| MT.CARROLL | ILLINOIS | MT.CARROLL STP | 2100 | 0.31 | 44 |
| VIRDEN | ILLINOIS | VIRDEN NORTH STP | 1750 | 0.20 | 46 |
| WHEATON | ILLINOIS | WHEATON WWTF | 53000 | 8.90 | 87 |
| YORKVILLE | ILLINOIS | YORKVILLE-BRISTOL | 4000 | 2.10 | 65 |
| AKRON | IOWA | AKRON WWTP | 1400 | 0.15 | 47 |
| ANKENY | IOWA | WESTWOOD PLANT #4 | 4590 | 0.46 | 28 |
| ANKENY | IOWA | WEST PLANT #2 | 10000 | 0.28 | 26 |
| ANKENY | IOWA | SOUTHEAST PLANT #3 | 12000 | 1.20 | 48 |
| BEDFORD | IOWA | BEDFORD STP | 1700 | 0.40 | 31 |
| CAMANCHE | IOWA | CAMANCHE WWTP | 4200 | 0.60 | 43 |
| CEDAR FALLS | IOWA | CEDAR FALLS WWTP | 35472 | 4.86 | 55 |
| CHEROKEE | IOWA | CHEROKEE WWTP | 7500 | 0.94 | 54 |
| CORALVILLE | IOWA | CORALVILLE WWTP | 6928 | 1.75 | 51 |
| EMMETSBURG | IOWA | EMMETSBURG STP | 4450 | 0.72 | 67 |
| ESTHERVILLE | IOWA | ESTHERVILLE WWTP | 8108 | 3.20 | 72 |
| FORT DODGE | IOWA | FORT DODGE WPCP | 28000 | 4.50 | 59 |
| GRIMES | IOWA | GRIMES WWTP | 1985 | 0.35 | 62 |
| GRINNELL | IOWA | GRINNELL WWTP | 8600 | 1.10 | 44 |
| HOPKINTON | IOWA | HOPKINTON WWTP | 800 | 0.20 | 46 |
| INDIANOLA | IOWA | INDIANOLA N. WWTP | 8000 | 1.50 | 75 |
| INDIANOLA | IOWA | INDIANOLA S. WWTP | 3000 | 0.65 | 59 |
| IOWA CITY | IOWA | IOWA CITY WPCP | 50000 | 8.00 | 47 |
| MARSHALLTOWN | IOWA | MARSHALLTOWN WPCP | 26000 | 5.50 | 60 |
| MARSHALLTOWN | IOWA | MARSHALLTOWN WPCP | 26000 | 5.50 | 76 |
| NEWTON | IOWA | NEWTON NW WWTP | 3141 | 0.22 | 28 |
| NEWTON | IOWA | NEWTON SOUTH WWTP | 6898 | 3.10 | 37 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| NEWTON | IOWA | NEWTON SW WWTP | 4145 | 0.50 | 18 |
| OSKALOOSA | IOWA | OSKALOOSA SW WWTP | 11000 | 0.81 | 47 |
| REINBECK | IOWA | REINBECK WWTP | 1711 | 0.27 | 41 |
| REINBECK | IOWA | REINBECK WWTP | 1800 | 0.28 | 37 |
| WATERLOO | IOWA | WATERLOO WPCP | 75000 | 20.35 | 96 |
| ANTHONY | KANSAS | ANTHONY WWTP | 2771 | 1.00 | 31 |
| COLWICH | KANSAS | COLWICH STP | 1000 | 0.12 | 42 |
| DE SOTO | KANSAS | DE SOTO WWTP | 2000 | 0.40 | 26 |
| EMPORIA | KANSAS | EMPORIA WWTP | 30000 | 4.00 | 48 |
| LAWRENCE | KANSAS | LAWRENCE WWTP | 54000 | 9.00 | 67 |
| LAWRENCE | KANSAS | LAWRENCE WWTP | 50000 | 9.00 | 85 |
| LENEXA | KANSAS | LENEXA WWTP | 10000 | 2.00 | 29 |
| MANHATTAN | KANSAS | MANHATTAN WWTP | 40000 | 6.20 | 56 |
| NEWTON | KANSAS | NEWTON WWTP | 17000 | 2.82 | 42 |
| TOPEKA | KANSAS | OAKLAND WWTP | 150000 | 20.00 | 66 |
| WICHITA | KANSAS | WICHITA WWTP 1&2 | 300000 | 40.00 | 65 |
| CADIZ | KENTUCKY | CADIZ STP | 2200 | 0.32 | 53 |
| GLASGOW | KENTUCKY | GLASGOW MSTP | 12000 | 4.00 | 110 |
| HOPKINSVILLE | KENTUCKY | HOPKINSVILLE N STP | 29000 | 1.74 | 68 |
| LEBANON | KENTUCKY | LEBANON MSTP | 6350 | 1.00 | 58 |
| LEXINGTON | KENTUCKY | TOWN BRANCH STP | 79750 | 18.00 | 115 |
| LOUISVILLE | KENTUCKY | OKOLONA STP | 21700 | 2.60 | 52 |
| LOUISVILLE | KENTUCKY | HITE CREEK WWTP | 3504 | 2.19 | 69 |
| MAYFIELD | KENTUCKY | MAYFIELD WWTP | 11356 | 2.30 | 56 |
| MT WASHINGTON | KENTUCKY | MT WASHINGTON WPCF | 3080 | 0.40 | 41 |
| MURRAY | KENTUCKY | MURRAY WWTP | 19040 | 2.50 | 66 |
| NICHOLASVILLE | KENTUCKY | W HICKMAN STP | 36841 | 8.75 | 84 |
| NICHOLASVILLE | KENTUCKY | W HICKMAN WWTP | 36841 | 8.75 | 84 |
| RUSSELLVILLE | KENTUCKY | RUSSELLVILLE STP | 9394 | 1.20 | 60 |
| ALEXANDRIA | LOUISIANA | ALEXANDRIA WWTF | 53000 | 14.00 | 53 |
| BOGALUSA | LOUISIANA | BOGALUSA WWTP | 18412 | 6.00 | 69 |
| BUNKIE | LOUISIANA | BUNKIE WWTP | 5500 | 1.00 | 43 |
| KENNER | LOUISIANA | PLANT 1 BIOFILTER | 19000 | 2.50 | 51 |
| KENNER | LOUISIANA | PLANT 1 ACT.SLUDGE | 9500 | 1.25 | 47 |
| KENNER | LOUISIANA | PLANT 2 | 38000 | 5.00 | 54 |
| LAFAYETTE | LOUISIANA | LAFAYETTE SOUTH ST | 66051 | 5.22 | 65 |
| LAFAYETTE | LOUISIANA | LAFAYETTE EAST WWT | 23638 | 2.03 | 63 |
| NEW ORLEANS | LOUISIANA | WEST BANK STP | 52340 | 10.00 | 77 |
| PORT ALLEN | LOUISIANA | PORT ALLEN STP | 8000 | 1.00 | 34 |
| RUSTON | LOUISIANA | NORTHSIDE STP | 15000 | 4.00 | 49 |
| SHHEVEPORT | LOUISIANA | LUCAS WWTP | 215000 | 24.00 | 91 |
| ACCOKEEK | MARYLAND | PISCATAWAY WWTP | 104000 | 15.00 | 96 |
| ANNAPOLIS | MARYLAND | BROADNECK WWTP | 16500 | 4.00 | 59 |
| ANNAPOLIS | MARYLAND | ANNAPOLIS WWTP | 50000 | 10.00 | 77 |
| ANNAPOLIS | MARYLAND | BROADCREEK WWTP | 567 | 0.75 | 35 |
| BOWIE | MARYLAND | BOWIE-BELAIR WWTP | 32500 | 2.65 | 73 |
| CAMBRIDGE | MARYLAND | CAMBRIDGE WWTP | 13000 | 8.10 | 91 |
| CHURCHTOWN | MARYLAND | BROADWATER WWTP | 0 | 2.00 | 58 |
| CROFTON | MARYLAND | PUTUXENT WWTP | 25000 | 4.00 | 53 |
| HAGERSTOWN | MARYLAND | HAGERSTOWN | 35800 | 8.00 | 87 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| LAUREL | MARYLAND | PARKWAY WWTP | 33800 | 7.50 | 93 |
| MANCHESTER | MARYLAND | MANCHESTER STP | 1500 | 0.25 | 48 |
| MARYLAND CITY | MARYLAND | MARYLAND CITY | 3960 | 0.75 | 44 |
| MAYO | MARYLAND | WOODLAND BEACH WWT | 5580 | 0.75 | 34 |
| RIVA | MARYLAND | SYLVAN SHORES WWTP | 1000 | 0.25 | 32 |
| RIVIERA BEACH | MARYLAND | COX CREEK WWTP | 65000 | 8.50 | 72 |
| THURMONT | MARYLAND | THURMONT STP | 3000 | 0.50 | 39 |
| UPPER MARLBORO | MARYLAND | WESTERN BRANCH WWT | 75400 | 15.00 | 111 |
| ADAMS | MASSACHUSETTS | ADAMS WWTP | 11000 | 10.20 | 69 |
| AMESBURY | MASSACHUSETTS | AMESBURY WWTP | 12500 | 1.90 | 56 |
| BELLERICA | MASSACHUSETTS | BELLERICA WWTP | 12000 | 1.60 | 49 |
| EAST DOUGLAS | MASSACHUSETTS | DOUGLAS WWTP | 2100 | 0.18 | 42 |
| FITCHBURG | MASSACHUSETTS | EAST FITCHBURG WWT | 40000 | 12.40 | 110 |
| GREAT BARRINGTO | MASSACHUSETTS | GREAT BARRINGTON T | 7500 | 3.20 | 58 |
| MANCHESTER | MASSACHUSETTS | MANCHESTER WWTP | 3500 | 0.67 | 43 |
| MEDFIELD | MASSACHUSETTS | MEDFIELD WWTP | 2000 | 1.50 | 57 |
| MILLBURY | MASSACHUSETTS | MILLBURY WPC PLANT | 6000 | 0.90 | 62 |
| ROCKPORT | MASSACHUSETTS | ROCKPORT WWTP | 4500 | 0.80 | 37 |
| SHREWSBURY | MASSACHUSETTS | SHREWSBURY WPCP | 11630 | 1.30 | 44 |
| WAREHAM | MASSACHUSETTS | WAREHAM WWTF | 3500 | 1.80 | 65 |
| WESTBOROUGH | MASSACHUSETTS | WESTBOROUGH WWTF | 7500 | 1.10 | 60 |
| FLINT | MICHIGAN | ANTHONY RAGNONE WT | 200000 | 20.00 | 119 |
| FRANKENMUTH | MICHIGAN | FRANKENMUTH WWTP | 3800 | 1.21 | 79 |
| GRANDVILLE | MICHIGAN | GRANDVILLE WWTP | 18000 | 3.20 | 70 |
| HASTINGS | MICHIGAN | HASTINGS WWTP | 6500 | 1.00 | 68 |
| IONIA | MICHIGAN | IONIA WWTP | 12000 | 4.00 | 74 |
| PETERSBURG | MICHIGAN | PETERSBURG WWTP | 1200 | 0.21 | 36 |
| PINCONNING | MICHIGAN | PINCONNING WWTP | 1500 | 1.00 | 68 |
| PORT HURON | MICHIGAN | PORT HURON WWTP | 55000 | 20.00 | 113 |
| TRAVERSE CITY | MICHIGAN | TRAVERSECITY WWTP | 21000 | 8.50 | 73 |
| TRENTON | MICHIGAN | TRENTON WWTP | 25000 | 5.50 | 97 |
| WARREN | MICHIGAN | WARREN WWTP | 167000 | 36.00 | 117 |
| WYOMING | MICHIGAN | WYOMING WWTP | 100000 | 19.00 | 83 |
| ZEELAND | MICHIGAN | ZEELAND WWTP | 5200 | 1.10 | 61 |
| ALEXANDRIA | MINNESOTA | ALEXANDRIA WWTP | 12000 | 2.55 | 64 |
| AUSTIN | MINNESOTA | AUSTIN WWTP | 26000 | 6.90 | 83 |
| DETROIT LAKES | MINNESOTA | DETROIT LAKES WWTP | 7500 | 1.44 | 77 |
| EAGAN | MINNESOTA | SENECA WWTP | 135000 | 24.00 | 93 |
| ELK RIVER | MINNESOTA | ELK RIVER WWTP | 2400 | 1.04 | 49 |
| FARIBAULT | MINNESOTA | FARIBAULT WPCP | 16000 | 3.50 | 69 |
| MANKATO | MINNESOTA | MANKATO WWTP | 45000 | 10.00 | 68 |
| MOORHEAD | MINNESOTA | MOORHEAD WWTP | 5000 | 4.50 | 79 |
| NORTHFIELD | MINNESOTA | NORTHFIELD MUN WWT | 12783 | 1.65 | 65 |
| ROCHESTER | MINNESOTA | ROCHESTER STP | 70000 | 12.50 | 80 |
| SHAKOPEE | MINNESOTA | BLUE LAKE WWTP | 120000 | 20.00 | 61 |
| TWO HARBORS | MINNESOTA | TWO HARBORS WWTP | 4437 | 1.20 | 80 |
| WILLMAR | MINNESOTA | WILLMAR WWTP | 20000 | 2.50 | 66 |
| WINONA | MINNESOTA | WINONA WWCP | 25000 | 6.50 | 58 |
| CLARKSDALE | MISSISSIPPI | CLARKSDALE STP | 21500 | 4.50 | 54 |
| GREENVILLE | MISSISSIPPI | GREENVILLE STP | 55000 | 20.00 | 64 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| OXFORD | MISSISSIPPI | OXFORD STP | 30000 | 3.50 | 58 |
| PICAYUNE | MISSISSIPPI | PICAYUNE STP | 12000 | 3.00 | 62 |
| VICKSBURG | MISSISSIPPI | VICKSBURG WWTP | 30000 | 7.50 | 67 |
| BELTON | MISSOURI | BELTON WWTP | 5250 | 1.00 | 52 |
| BOLIVAR | MISSOURI | BOLIVAR WWTP | 6200 | 0.98 | 39 |
| CAPE GIRARDEAU | MISSOURI | CAPE GIRARDEAU STP | 30000 | 7.00 | 52 |
| COLUMBIA | MISSOURI | PLANT #1 | 11000 | 2.00 | 49 |
| FLORISSANT | MISSOURI | COLDWATER CREEK ST | 185000 | 25.00 | 80 |
| KANSAS CITY | MISSOURI | BIRMINGHAM WWTP | 50000 | 4.00 | 43 |
| KANSAS CITY | MISSOURI | TODD CK. STP | 6000 | 2.00 | 43 |
| KANSAS CITY | MISSOURI | PLATTE CO. STP | 7000 | 1.00 | 44 |
| KIRKSVILLE | MISSOURI | KIRKSVILLE WWTP | 17000 | 5.00 | 75 |
| LICKING | MISSOURI | NORTHWEST STP | 1900 | 0.25 | 49 |
| MARSHALL | MISSOURI | SOUTHEAST WWTP | 12799 | 3.88 | 47 |
| MARSHALL | MISSOURI | SOUTHEAST STP | 15000 | 3.90 | 55 |
| MARSHFIELD | MISSOURI | MARSHFIELD WWTF | 3800 | 1.00 | 31 |
| MARSHFIELD | MISSOURI | MARSHFIELD WWTP | 4200 | 1.00 | 40 |
| MEXICO | MISSOURI | MEXICO STP | 11500 | 1.90 | 49 |
| MEXICO | MISSOURI | MEXICO STP | 13000 | 2.40 | 51 |
| MOBERLY | MISSOURI | EAST STP | 10000 | 1.70 | 49 |
| SAINT CHARLES | MISSOURI | MISSISSIPPI RIVER | 40000 | 5.50 | 80 |
| SALEM | MISSOURI | SALEM STP | 4300 | 0.80 | 32 |
| SEDALIA | MISSOURI | SEDALIA STP | 24000 | 2.50 | 53 |
| SPRINGFIELD | MISSOURI | N.W. STP | 15000 | 3.50 | 58 |
| ST CHARLES | MISSOURI | MISS.RIVER PLANT | 30000 | 5.50 | 93 |
| ST. CHARLES | MISSOURI | MISSISSIPPI R. STP | 29000 | 5.50 | 84 |
| ST. LOUIS | MISSOURI | COLDWATER CK. STP | 225000 | 25.00 | 80 |
| COLUMBIA FALLS | MONTANA | COLUMBIA FALLS WWT | 2100 | 0.50 | 53 |
| HELENA | MONTANA | HELENA WWTP | 23800 | 6.00 | 67 |
| BELLEVUE | NEBRASKA | BELLEVUE WWTP | 10500 | 1.90 | 64 |
| COLUMBUS | NEBRASKA | COLUMBUS WWTP | 18000 | 2.60 | 39 |
| CRETE | NEBRASKA | CRETE WWTP | 4500 | 1.05 | 60 |
| FALLS CITY | NEBRASKA | FALLS CITY WWTP | 5440 | 1.00 | 33 |
| FREMONT | NEBRASKA | FREMONT WWTP | 26000 | 10.50 | 73 |
| GIBBON | NEBRASKA | GIBBON WWTP | 1500 | 1.14 | 47 |
| GRAND ISLAND | NEBRASKA | GRAND ISLAND WPCP | 32000 | 5.80 | 60 |
| HASTINGS | NEBRASKA | HASTINGS WPCP | 25000 | 3.00 | 47 |
| KEARNEY | NEBRASKA | KEARNEY WWTP | 30000 | 3.00 | 43 |
| LINCOLN | NEBRASKA | THERESA ST WWTR | 180000 | 30.00 | 88 |
| NEWMAN GROVE | NEBRASKA | NEWMAN GROVE WWTP | 863 | 0.14 | 44 |
| SUPERIOR | NEBRASKA | SUPERIOR WWTP | 3512 | 1.57 | 58 |
| WEST POINT | NEBRASKA | WEST POINT WWTP | 3600 | 0.58 | 43 |
| YORK | NEBRASKA | YORK WWTP | 7500 | 3.00 | 69 |
| BELFORD | NEW JERSEY | TWP MIDDLETON WWTP | 65000 | 6.50 | 71 |
| BIRMINGHAM | NEW JERSEY | PEMBERTON TWP WWTP | 14000 | 2.50 | 75 |
| BRICK TOWN | NEW JERSEY | NORTHERN WPCF | 126973 | 28.00 | 86 |
| BRIDGEPORT | NEW JERSEY | LOGAN TWP WWTP | 2300 | 1.00 | 47 |
| BRIDGEWATER | NEW JERSEY | SOM BAR VAL WWTP | 80000 | 10.00 | 97 |
| EAST WINDSOR | NEW JERSEY | E WINDSOR MUA WWTP | 22000 | 2.23 | 72 |
| ELIZABETH | NEW JERSEY | JOINT MEETING WWTF | 500000 | 75.00 | 76 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| HACKETTSTOWN | NEW JERSEY | HACKETTSTOWN MUA W | 13600 | 1.65 | 53 |
| LAMBERTVILLE | NEW JERSEY | LAMBERTVILLE STP | 7000 | 0.65 | 57 |
| LARENCEVILLE | NEW JERSEY | EWING-LAWRENCE WWT | 65000 | 9.00 | 86 |
| LONG BRANCH | NEW JERSEY | LONG BRANCH WWTP | 34000 | 5.40 | 84 |
| LONG VALLEY | NEW JERSEY | SCHOOLEYS MTN WWTP | 2412 | 0.50 | 45 |
| MARLTON | NEW JERSEY | WOODSTREAM WTP | 10000 | 1.25 | 38 |
| MARLTON | NEW JERSEY | ELMWOOD WTP | 10000 | 1.50 | 46 |
| MATAWAN | NEW JERSEY | STRATHMOORE STP | 10020 | 0.80 | 34 |
| MATAWAN | NEW JERSEY | CLIFFWOOD BEACH ST | 6000 | 0.75 | 37 |
| MATAWAN | NEW JERSEY | RIVER GARDENS STP | 1400 | 0.10 | 36 |
| MEDFORD | NEW JERSEY | MEDFORD TWP WWTP | 15500 | 1.30 | 59 |
| NEPTUNE | NEW JERSEY | TWP OF NEPTUNE WWT | 85000 | 8.50 | 62 |
| OAKHURST | NEW JERSEY | TWP OF OCEAN WWTP | 35000 | 3.60 | 71 |
| ORTLEY BEACH | NEW JERSEY | ORTLEY BEACH PLANT | 60000 | 12.00 | 72 |
| RAHWAY | NEW JERSEY | RAHWAY VALLY WWTP | 215000 | 35.00 | 88 |
| SAYREVILLE | NEW JERSEY | MIDDLESEX CO WWTP | 600000 | 120.00 | 85 |
| WEST CREEK | NEW JERSEY | SOUTHERN WPCF | 88550 | 20.00 | 74 |
| WILLINGBORO | NEW JERSEY | WILLINGBORO MUN PL | 56450 | 4.20 | 74 |
| LAS VEGAS | NEW MEXICO | LAS VEGAS EAST STP | 8000 | 0.85 | 46 |
| LAS VEGAS | NEW MEXICO | LAS VEGAS WEST STP | 6000 | 0.35 | 46 |
| RATON | NEW MEXICO | RATON STP | 9000 | 1.20 | 49 |
| SANTA FE | NEW MEXICO | SILER ROAD STP | 14850 | 2.70 | 45 |
| SANTA FE | NEW MEXICO | AIRPORT ROAD STP | 29700 | 3.00 | 53 |
| TAOS | NEW MEXICO | TAOS STP | 3000 | 0.40 | 46 |
| HARRIMAN-MONROE | NEW YORK | ORANGE CO SD 1 STP | 9200 | 2.00 | 67 |
| MANLIUS | NEW YORK | MEADOWBROOK-LIMEST | 32192 | 7.00 | 64 |
| ORANGEBURG | NEW YORK | ROCKLAND COUNTY ST | 145000 | 10.00 | 98 |
| ALFRED | NEW YORK | ALFRED WWTP | 8500 | 1.00 | 57 |
| APALACHIN | NEW YORK | OWEGO WPCP # 2 | 7500 | 2.00 | 58 |
| AVON | NEW YORK | AVON WWTP | 11410 | 2.75 | 57 |
| BATAVIA | NEW YORK | BATAVIA WPCP | 19500 | 2.50 | 61 |
| BATH | NEW YORK | BATH WWTP | 6530 | 1.00 | 51 |
| BAY PARK | NEW YORK | NASSAU COUNTY SD#2 | 556000 | 60.00 | 178 |
| BEACON | NEW YORK | BEACON STP | 13800 | 6.00 | 87 |
| CANISTEO | NEW YORK | CANISTEO STP | 2772 | 0.40 | 44 |
| CANTON | NEW YORK | CANTON WPCP | 10000 | 2.00 | 66 |
| CAPE VINCENT | NEW YORK | CAPE VINCENT STP | 1500 | 0.14 | 46 |
| CARMEL | NEW YORK | CARMEL STP | 3000 | 0.35 | 33 |
| CAYUGA HEIGHTS | NEW YORK | CAYUGA HTS WWTP | 11000 | 2.00 | 72 |
| CAYUGA HGTS | NEW YORK | CAYUGA HGTS WPCP | 8000 | 2.00 | 63 |
| CEDAR HILL | NEW YORK | BETHLEHEM WWTP | 18000 | 4.90 | 59 |
| CEDARHURST | NEW YORK | CEDARHURST WPCP | 8200 | 1.00 | 52 |
| CHEEKTOWAGA | NEW YORK | CHEEKTOWAGA SD #5 | 80000 | 7.50 | 67 |
| E.ROCKAWAY | NEW YORK | BAY PARK STP | 558400 | 60.00 | 70 |
| ELMIRA | NEW YORK | CHEMUNG CO SD #1 | 4970 | 4.80 | 60 |
| ENDICOTT | NEW YORK | ENDICOTT STP | 49000 | 10.00 | 77 |
| FLORIDA | NEW YORK | FLORIDA WWTP | 2000 | 0.30 | 49 |
| FREEPORT | NEW YORK | FREEPORT STP | 42000 | 4.00 | 61 |
| GOSHEN | NEW YORK | GOSHEN STP | 8000 | 1.50 | 53 |
| GREAT NECK | NEW YORK | BELGRAVE WWTP | 13000 | 1.50 | 51 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| GREECE | NEW YORK | GREECE NW QUAD WWT | 132000 | 15.00 | 92 |
| HALFMOON | NEW YORK | SARATOGA CO 1 WWTP | 54263 | 13.00 | 84 |
| HOLCOMB | NEW YORK | HOLCOMB STP | 1421 | 0.23 | 62 |
| LIVONIA | NEW YORK | CONESUS LAKE SD | 4800 | 1.27 | 65 |
| LONG BEACH | NEW YORK | LONG BEACH WPCP | 35000 | 6.36 | 62 |
| LYONS | NEW YORK | LYONS STP | 4300 | 0.75 | 62 |
| MANLIUS | NEW YORK | MEADOWBROOKLIMESTO | 25900 | 7.00 | 55 |
| NEWBURGH | NEW YORK | GIDNEYTOWN STP | 1200 | 0.12 | 56 |
| NEWBURGH | NEW YORK | GOLDEN PARK STP | 615 | 0.20 | 44 |
| NEWBURGH | NEW YORK | MEADOWHILL NORTH S | 1500 | 0.20 | 43 |
| NEWFANE | NEW YORK | NEWFANE STP | 4875 | 1.60 | 60 |
| NIAGARA FALLS | NEW YORK | NIAGARA SD #1 | 2000 | 999.99 | 81 |
| NORTHPORT | NEW YORK | NORTHPORT STP | 2500 | 0.30 | 44 |
| ORANGEBURG | NEW YORK | ORANGETOWN STP | 70000 | 8.50 | 76 |
| ORANGETOWN | NEW YORK | ORANGETOWN WWTP | 52000 | 8.50 | 61 |
| OYSTER BAY | NEW YORK | OYSTER BAY STP | 7500 | 1.20 | 60 |
| PENN YAN | NEW YORK | PENN YAN WWTP | 5200 | 1.50 | 57 |
| PLATTSBURGH | NEW YORK | PLATTSBURGH STP | 40000 | 16.00 | 74 |
| POLAND (TN OF) | NEW YORK | JAMESTOWN STP | 40000 | 8.00 | 64 |
| PORT WASHINGTON | NEW YORK | PORT WASHINGTON ST | 30000 | 3.00 | 59 |
| POUGHKEEPSIE | NEW YORK | ARLINGTON STP | 23000 | 4.00 | 73 |
| ROCHESTER | NEW YORK | GATES CHILI OGDEN | 85800 | 15.00 | 112 |
| SAG HARBOR | NEW YORK | SAG HARBOR WWTP | 2400 | 0.10 | 47 |
| SARANAC LAKE | NEW YORK | SARANAC LAKE WPCP | 10000 | 3.00 | 66 |
| SARANAC LAKE | NEW YORK | SARANAC LAKE STP | 15300 | 2.00 | 57 |
| SOUTH FALLSBURG | NEW YORK | SOUTH FALLSBURG ST | 2500 | 1.20 | 53 |
| SPENCERPORT | NEW YORK | SPENCERPORT WWTP | 6600 | 1.00 | 50 |
| STONY POINT | NEW YORK | STONY POINT STP | 9000 | 1.00 | 46 |
| TONAWANDA | NEW YORK | TWO MILE CREEK STP | 129000 | 30.00 | 104 |
| TRUMANSBURG | NEW YORK | TRUMANSBURG WWTP | 2000 | 0.25 | 49 |
| TULLY | NEW YORK | TULLY WPCP | 1100 | 0.25 | 48 |
| VIL OF FISHKILL | NEW YORK | FISHKILL STP | 1400 | 0.40 | 47 |
| WANTAGH | NEW YORK | CEDAR CREEK WPCP | 235000 | 45.00 | 79 |
| WAPPINGER FALLS | NEW YORK | OAKWOOD KNOLLS STP | 407 | 0.20 | 46 |
| WASHINGTONVILLE | NEW YORK | WASHINGTONVILLE ST | 2000 | 0.40 | 53 |
| WEBSTER | NEW YORK | WEBSTER WWTP | 7500 | 2.50 | 52 |
| WEST LONG BEACH | NEW YORK | WEST LONG BEACH ST | 4000 | 1.50 | 51 |
| YORKTOWN | NEW YORK | YORKTOWN HEIGHTS T | 13000 | 1.50 | 86 |
| YORKTOWN | NEW YORK | YORKTOWN,OSCEOLA S | 2388 | 0.20 | 46 |
| ORANGEBURG | NEW YORK | ROCKLAND CO SD #1 | 40000 | 10.00 | 78 |
| ALBMEARLE | NORTH CAROLINA | LONG CREEK WWTP | 14000 | 16.00 | 79 |
| GASTONIA | NORTH CAROLINA | CATABA CREEK WTP | 50000 | 9.00 | 67 |
| GASTONIA | NORTH CAROLINA | LONG CREEK WTP | 14000 | 9.00 | 64 |
| GREENSBORO | NORTH CAROLINA | NORTH BUFFALO WTP | 196000 | 18.00 | 99 |
| GREENVILLE | NORTH CAROLINA | GREENVILLE WWTP | 33000 | 8.00 | 60 |
| GRIFTON | NORTH CAROLINA | CONTENTNEA M S D | 8390 | 4.73 | 52 |
| LENOIR | NORTH CAROLINA | GRANT CREEK WTP | 15000 | 6.00 | 42 |
| MAXTON | NORTH CAROLINA | MAXTON WWTP | 2500 | 0.30 | 37 |
| NEW BERN | NORTH CAROLINA | NEW BERN WWTP | 18000 | 4.00 | 53 |
| PEMBROKE | NORTH CAROLINA | PEMBROKE WWTP | 4000 | 0.50 | 43 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| RALEIGH | NORTH CAROLINA | NEUSE RIVER WTP | 188335 | 30.00 | 96 |
| ROCKINGHAM | NORTH CAROLINA | ROCKINGHAM WTP | 10100 | 6.00 | 53 |
| SALISBURY | NORTH CAROLINA | GRANT CREK WWTP | 10200 | 5.00 | 91 |
| SALISBURY | NORTH CAROLINA | TOWN CREEK WWTP | 10500 | 5.00 | 91 |
| WASHINGTON | NORTH CAROLINA | WASHINGTON MUN WTP | 8900 | 2.20 | 58 |
| ATHENS | OHIO | ATHENS WWTP | 32000 | 4.80 | 66 |
| BARBERTON | OHIO | BARBERTON STP | 35300 | 8.00 | 58 |
| BEDFORD | OHIO | BEDFORD STP | 16500 | 3.20 | 56 |
| BOARDMAN | OHIO | BOARDMAN WWTP | 12000 | 5.00 | 61 |
| CLEVELAND | OHIO | EASTERLY WWTP | 540000 | 123.00 | 620 |
| COLUMBUS | OHIO | SOUTHERLY WWTP | 340000 | 100.00 | 77 |
| COLUMBUS | OHIO | JACKSON PIKE WWTP | 515000 | 100.00 | 107 |
| DAYTON | OHIO | DAYTON WWTP | 317000 | 60.00 | 74 |
| FAIRBORN | OHIO | FAIRBORN WWTP | 36000 | 5.50 | 71 |
| GREENVILLE | OHIO | GREENVILLE WWTP | 13500 | 3.00 | 37 |
| HAMILTON | OHIO | HAMILTON WWTP | 21274 | 25.00 | 73 |
| HEATH | OHIO | HEATH WWTP | 8020 | 2.00 | 56 |
| LOGAN | OHIO | LOGAN WWTP | 6000 | 1.20 | 57 |
| MIAMISBURG | OHIO | MIAMISBURG STP | 18200 | 2.20 | 67 |
| NEWARK | OHIO | NEWARK WWTP | 37000 | 12.00 | 74 |
| RAVENNA | OHIO | RAVENNA STP | 12000 | 1.90 | 80 |
| SIDNEY | OHIO | SIDNEY WWTP | 17000 | 2.50 | 42 |
| SIDNEY | OHIO | SIDNEY WWTP | 18000 | 4.00 | 70 |
| SOLON | OHIO | SOLON CENTRAL STP | 11500 | 2.40 | 72 |
| SOLON | OHIO | SOLON NE STP | 4000 | 0.80 | 43 |
| TROY | OHIO | TROY WWTP | 18000 | 6.20 | 71 |
| VANDALIA | OHIO | VANDALIA WWTP | 12400 | 1.20 | 47 |
| WATERVILLE | OHIO | MAUMEE RIVER STP | 20000 | 6.00 | 88 |
| XENIA | OHIO | FORD ROAD WWTP | 28500 | 3.00 | 54 |
| ARDMORE | OKLAHOMA | SOUTHWEST STP | 14000 | 2.50 | 51 |
| ARDMORE | OKLAHOMA | NORTHEAST STP | 12000 | 2.50 | 51 |
| BLACKWELL | OKLAHOMA | BLACKWELL STP | 8645 | 2.20 | 47 |
| BROKEN BOW | OKLAHOMA | BROKEN BOW WPCP | 4000 | 0.75 | 57 |
| HENRYETTA | OKLAHOMA | HENRYETTA WPCP | 7500 | 0.90 | 46 |
| IDABEL | OKLAHOMA | IDABEL WPCF | 12000 | 2.50 | 44 |
| MUSKOGEE | OKLAHOMA | MUSKOGEE WWTP | 40000 | 12.00 | 67 |
| NORMAN | OKLAHOMA | NORMAN STP | 63000 | 10.00 | 107 |
| OKLAHOMA | OKLAHOMA | CHISHOLM CREEK AWT | 50000 | 5.00 | 69 |
| OKLAHOMA CITY | OKLAHOMA | NORTHSIDE WWTP | 150000 | 10.00 | 61 |
| OKLAHOMA CITY | OKLAHOMA | SOUTHSIDE WWTP | 300000 | 25.00 | 60 |
| OKMULGEE | OKLAHOMA | OKMULGEE WWTP | 20000 | 5.00 | 76 |
| PONCA CITY | OKLAHOMA | PONCA CITY WWTP | 30000 | 4.00 | 58 |
| TULSA | OKLAHOMA | FLATROCK STP | 57874 | 6.20 | 61 |
| TULSA | OKLAHOMA | COAL CREEK STP | 31946 | 4.00 | 46 |
| TULSA | OKLAHOMA | NORTHSIDE STP | 91251 | 19.00 | 100 |
| TULSA | OKLAHOMA | SOUTHSIDE STP | 200000 | 31.50 | 116 |
| CLATSKANIE | OREGON | CLATSKANIE STP | 1700 | 0.50 | 52 |
| COTTAGE GROVE | OREGON | COTTAGE GROVE STP | 7500 | 1.50 | 60 |
| DALLAS | OREGON | DALLAS STP | 9000 | 2.00 | 45 |
| DEPOE BAY | OREGON | DEPOE BAY STP | 1650 | 0.80 | 46 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| EUGENE | OREGON | EUGENE WWTP | 106000 | 17.10 | 71 |
| EUGENE | OREGON | EUGENE STP | 90000 | 17.10 | 70 |
| FOREST GROVE | OREGON | FOREST GROVE WWTP | 19347 | 5.00 | 81 |
| GASTON | OREGON | GASTON STP | 642 | 0.06 | 39 |
| GLENEDON BEACH | OREGON | SILETZ KEYS STP | 25 | 0.01 | 30 |
| HILLSBORO | OREGON | HILLSBORO WEST STP | 7765 | 2.00 | 71 |
| HILLSBORO | OREGON | ROCK CREEK STP | 100747 | 15.00 | 99 |
| HOOD RIVER | OREGON | HOOD RIVER STP | 4500 | 3.50 | 87 |
| OTTER ROCK | OREGON | OTTER CREST INN ST | 600 | 0.13 | 35 |
| PORTLAND | OREGON | TRYON CREEK STP | 39208 | 8.34 | 74 |
| PORTLAND | OREGON | INVERNESS STP | 10829 | 2.00 | 45 |
| SALEM | OREGON | WILLOW LAKE STP | 135000 | 35.00 | 88 |
| SPRINGFIELD | OREGON | SPRINGFIELD STP | 39350 | 6.90 | 62 |
| THE DALLES | OREGON | THE DALLES STP | 16075 | 4.15 | 62 |
| TIGARD | OREGON | DURHAM ADV.WWTP | 120000 | 20.00 | 117 |
| TILLAMOOK | OREGON | TILLAMOOK STP | 4300 | 1.06 | 48 |
| WEST SALEM | OREGON | WALLACE ROAD STP | 3500 | 0.40 | 41 |
| WILSONVILLE | OREGON | DAMASCH ST HOSP ST | 1000 | 0.30 | 46 |
| ALLENTOWN | PENNSYLVANIA | KLINE'S ISLAND WWT | 179000 | 40.00 | 101 |
| AMBLER | PENNSYLVANIA | AMBLER SOUTH WWTP | 32300 | 3.26 | 53 |
| BADEN | PENNSYLVANIA | BADEN STP | 7000 | 0.50 | 53 |
| BETHLEHEM | PENNSYLVANIA | BETHLEHEM WWTP | 100000 | 12.50 | 79 |
| BLOOMSBURG | PENNSYLVANIA | BLOOMSBURG STP | 15000 | 4.30 | 60 |
| CENTER VALLEY | PENNSYLVANIA | UPPER SAUCON TWP W | 9000 | 0.60 | 62 |
| CHAMBERSBURG | PENNSYLVANIA | CHAMBERSBURG WWTP | 17000 | 3.00 | 53 |
| CHINCHILLA | PENNSYLVANIA | CLARKS-SUMMITTS. A | 10000 | 1.20 | 41 |
| CONSHOHOCKEN | PENNSYLVANIA | CONSHOHOCKEN WPCP | 17500 | 1.30 | 57 |
| DUNCANSVILLE | PENNSYLVANIA | DUNCANSVILLE WWTP | 7000 | 0.25 | 35 |
| DURYEA | PENNSYLVANIA | L LACKAWANNA V STP | 28749 | 6.00 | 85 |
| FOLCROFT | PENNSYLVANIA | MUCKINPATES WWTP | 78000 | 6.00 | 55 |
| GROVE CITY | PENNSYLVANIA | GROVE CITY STP | 8300 | 1.50 | 54 |
| HARLEYSVILLE | PENNSYLVANIA | LOWER SALFORD TWP | 2900 | 0.30 | 50 |
| HASTINGS | PENNSYLVANIA | HASTINGS WWTP | 2100 | 0.21 | 33 |
| HATFIELD | PENNSYLVANIA | HATFIELD TWP AUT | 10000 | 3.60 | 86 |
| HERSHEY | PENNSYLVANIA | DERRY TOWNSHIP WPC | 20000 | 5.00 | 80 |
| KINGSTON TWP | PENNSYLVANIA | DALLAS AREA MUN. A | 22000 | 2.20 | 49 |
| LEBANON | PENNSYLVANIA | LEBANON STP | 32300 | 6.80 | 86 |
| LEMOYNE | PENNSYLVANIA | LEMOYNE BORO JT. A | 16500 | 2.10 | 57 |
| LITITZ | PENNSYLVANIA | LITITZ STP | 7600 | 1.20 | 45 |
| MCCANDLESS | PENNSYLVANIA | PINECREEK STP | 8500 | 3.00 | 69 |
| MECHANICSBURG | PENNSYLVANIA | MECHANICSBURG STP | 9500 | 1.20 | 54 |
| NEW HOLLAND | PENNSYLVANIA | NEW HOLLAND STP | 4500 | 1.00 | 54 |
| OAKMONT | PENNSYLVANIA | OAKMONT STP | 8300 | 1.20 | 69 |
| PLEASANT HILLS | PENNSYLVANIA | PLEASANT HILLS | 22000 | 3.00 | 79 |
| POTTSTOWN | PENNSYLVANIA | POTTSTOWN WWTP | 33000 | 7.40 | 86 |
| READING | PENNSYLVANIA | FRITZ ISLAND WWTP | 102000 | 13.50 | 86 |
| ROBESONIA | PENNSYLVANIA | ROBESONIA-WERNERSV | 3300 | 0.60 | 48 |
| SHARON HILL | PENNSYLVANIA | DARBY CREEK WWTP | 98921 | 10.00 | 69 |
| SINKING SPRING | PENNSYLVANIA | SINKING SPRING WWT | 3200 | 0.35 | 45 |
| SPRINGETTSBURY | PENNSYLVANIA | SPRINGETTSBURY TWP | 48000 | 8.00 | 74 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| WEST READING | PENNSYLVANIA | WYOMISSING VAL STP | 20000 | 3.00 | 64 |
| WILLOW GROVE | PENNSYLVANIA | U MORELAND-HATBORO | 30000 | 6.00 | 80 |
| EAST GREENWICH | RHODE ISLAND | EAST GREENWICH STP | 3000 | 0.51 | 47 |
| EAST PROVIDENCE | RHODE ISLAND | EAST PROVIDENCEWPC | 40000 | 10.40 | 77 |
| WARWICK | RHODE ISLAND | WARWICK SATP | 13500 | 5.00 | 69 |
| BATESBURG | SOUTH CAROLINA | BATESBURG STP | 4500 | 1.30 | 43 |
| COLUMBIA | SOUTH CAROLINA | COLUMBIA METRO STP | 200000 | 20.00 | 103 |
| LANCASTER | SOUTH CAROLINA | LANCASTER STP | 18000 | 3.00 | 50 |
| MARION | SOUTH CAROLINA | WITHLACOOCHEE STP | 3300 | 1.00 | 50 |
| ROCK HILL | SOUTH CAROLINA | MANCHESTER CREEK S | 27185 | 12.00 | 69 |
| ROCK HILL | SOUTH CAROLINA | WILDCAT STP | 4942 | 0.50 | 49 |
| UNION | SOUTH CAROLINA | MENGS CREEK STP | 2500 | 1.00 | 42 |
| UNION | SOUTH CAROLINA | TOSHES CREEK STP | 5000 | 6.00 | 45 |
| CUSTER | SOUTH DAKOTA | CUSTER WPCP | 2200 | 0.56 | 45 |
| DEADWOOD | SOUTH DAKOTA | LEAD DEADWOOD STP | 8000 | 2.33 | 69 |
| RAPID CITY | SOUTH DAKOTA | RAPID CITY WPCP | 60000 | 13.50 | 61 |
| RAPID CITY | SOUTH DAKOTA | RAPID CITY STP | 50000 | 13.50 | 69 |
| YANKTON | SOUTH DAKOTA | YANKTON WWTP | 15000 | 1.80 | 56 |
| CENTERVILLE | TENNESSEE | CENTERVILLE WWTP # | 2495 | 0.30 | 43 |
| CLEVELAND | TENNESSEE | CLEVELAND WWTP | 30000 | 12.00 | 69 |
| DICKSON | TENNESSEE | PINEY RIVER WWTP | 3500 | 0.65 | 60 |
| DICKSON | TENNESSEE | JONES CREEK WWTP | 5500 | 0.90 | 53 |
| FAYETTEVILLE | TENNESSEE | FAYETTEVILLE WWTP | 8500 | 2.00 | 63 |
| FRANKLIN | TENNESSEE | FRANKLIN WWTP | 10500 | 2.50 | 66 |
| KNOXVILLE | TENNESSEE | HALLSDALE POWEL ST | 16750 | 2.10 | 83 |
| KNOXVILLE | TENNESSEE | FOURTH CREEK WWTP | 63794 | 7.72 | 81 |
| LAVERGNE | TENNESSEE | LAVERGNE WWTP | 476 | 0.08 | 50 |
| MARYVILLE | TENNESSEE | MARYVILLE REG WWTP | 15000 | 7.50 | 90 |
| MEMPHIS | TENNESSEE | NORTH WWTP | 350000 | 135.00 | 79 |
| MEMPHIS | TENNESSEE | T.E. MAXSON WWTP | 325000 | 80.00 | 85 |
| NASHVILLE | TENNESSEE | DRY CREEK WWTP | 25000 | 6.00 | 65 |
| NASHVILLE | TENNESSEE | CENTRAL WWTP | 323957 | 55.00 | 98 |
| NASHVILLE | TENNESSEE | WHITES CREEK WWTP | 50000 | 25.00 | 80 |
| SOUTH PITTSBURG | TENNESSEE | SOUTH PITTSBURG ST | 4200 | 1.07 | 47 |
| ATHENS | TEXAS | ATHENS NORTH STP | 4000 | 0.90 | 38 |
| ATHENS | TEXAS | ATHENS WEST STP | 9200 | 0.92 | 34 |
| AUSTIN | TEXAS | GOVALLE STP | 159000 | 26.00 | 59 |
| AUSTIN | TEXAS | WALNUT CREEK STP | 148000 | 25.00 | 74 |
| AUSTIN | TEXAS | WALNUT CK WWTP | 148000 | 18.00 | 68 |
| AUSTIN | TEXAS | GOVALLE WWTP | 159000 | 40.00 | 58 |
| BAYTOWN | TEXAS | EAST DISTRICT STP | 24000 | 3.00 | 59 |
| BAYTOWN | TEXAS | CENTRAL DIST. STP | 24450 | 4.70 | 54 |
| BAYTOWN | TEXAS | LAKEWOOD STP | 6672 | 0.70 | 50 |
| BAYTOWN | TEXAS | W MAIN STP | 26500 | 4.70 | 67 |
| BAYTOWN | TEXAS | E DIST STP | 18000 | 3.00 | 45 |
| BROWNSVILLE | TEXAS | S.PLANT (MAIN PLAN | 70000 | 7.50 | 72 |
| CONROE | TEXAS | SOUTHEAST STP | 10000 | 4.00 | 41 |
| CONROE | TEXAS | SOUTHWEST STP | 20000 | 2.00 | 51 |
| CORPUS CHRISTI | TEXAS | BROADWAY STP | 18600 | 10.00 | 63 |
| CORPUS CHRISTI | TEXAS | BROADWAY STP | 57800 | 12.00 | 72 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| CORPUS CHRISTI | TEXAS | ALLISON STP | 8900 | 2.00 | 58 |
| CORPUS CHRISTI | TEXAS | WESTSIDE STP | 16500 | 3.00 | 34 |
| CORSICANA | TEXAS | CORSICANA #2 | 14000 | 1.50 | 60 |
| CORSICANA | TEXAS | CORSICANA #1 | 7000 | 1.00 | 55 |
| DICKENSON | TEXAS | WCID STP #1 | 13800 | 4.20 | 63 |
| FLOWER MOUND | TEXAS | FLOWER MOUND MUD 1 | 1500 | 1.50 | 54 |
| FT WORTH | TEXAS | VILLAGE CREEK STP | 363612 | 45.00 | 78 |
| GALVESTON | TEXAS | MAIN PLANT | 54000 | 10.00 | 78 |
| GALVESTON | TEXAS | AIRPORT STP | 9000 | 1.00 | 46 |
| GEORGETOWN | TEXAS | GEORGETOWN WWTP | 10000 | 1.00 | 35 |
| HITCHCOCK | TEXAS | HITCHCOCK WWTP | 5700 | 0.74 | 38 |
| HOUSTON | TEXAS | N. SIDE STP | 465000 | 138.00 | 64 |
| HOUSTON | TEXAS | CLINTON PARK STP | 5500 | 0.80 | 43 |
| HOUSTON | TEXAS | CHOCOLATE BAYOU ST | 15000 | 1.60 | 49 |
| HUNTSVILLE | TEXAS | S STP | 6000 | 0.80 | 43 |
| HUNTSVILLE | TEXAS | SOUTH WWTP | 8000 | 1.60 | 42 |
| HUNTSVILLE | TEXAS | NORTH WWTP | 15000 | 2.10 | 54 |
| LEWISVILLE | TEXAS | LEWISVILLE WTP | 30000 | 6.00 | 70 |
| LEWISVILLE | TEXAS | LEWISVILLE WWTP | 23000 | 6.00 | 97 |
| MEXIA | TEXAS | MEXIA STP | 6200 | 1.50 | 55 |
| NACOGDOCHES | TEXAS | PLANT # 2-A | 26000 | 2.80 | 47 |
| NACOGDOCHES | TEXAS | PLANT # 1 | 8165 | 2.00 | 56 |
| PALESTINE | TEXAS | WELLS CREEK STP | 9300 | 1.50 | 39 |
| PALESTINE | TEXAS | TOWN CREEK STP | 5200 | 1.80 | 52 |
| PASEDENA | TEXAS | DEEPWATER STP | 29000 | 4.00 | 60 |
| PASEDENA | TEXAS | VINCE BAYOU STP A& | 30000 | 7.00 | 69 |
| PORT ARTHUR | TEXAS | MAIN WWTP | 69000 | 8.00 | 65 |
| PORT LAVACA | TEXAS | LYNN'S BAYOU STP | 10000 | 1.00 | 45 |
| PORT LAVACA | TEXAS | BLARDONE WWTP | 3000 | 0.50 | 32 |
| SAN ANTONIO | TEXAS | BILLING ROAD WWTP | 933000 | 100.00 | 105 |
| SAN ANTONIO | TEXAS | LEON CREEK WWTP | 81400 | 24.00 | 96 |
| TEMPLE | TEXAS | DOSIER FARM WWTP | 23000 | 5.00 | 59 |
| TEXAS CITY | TEXAS | TEXAS CITY STP | 43000 | 4.40 | 62 |
| TEXAS CITY | TEXAS | STP #1 | 70000 | 4.50 | 71 |
| TEXAS CITY | TEXAS | STP #2 | 8000 | 0.80 | 62 |
| WACO | TEXAS | TEMPLE-BELTON STP | 40000 | 5.00 | 65 |
| WACO | TEXAS | #2 WACO BRA | 20000 | 2.80 | 62 |
| WACO | TEXAS | WACO METRO REG SS | 33000 | 5.00 | 57 |
| WACO | TEXAS | WACO METRO REG SS | 100000 | 18.50 | 72 |
| COTTONWOOD | UTAH | COTTONWOOD STP | 80000 | 8.00 | 56 |
| GRANGER | UTAH | GRANGER-HUNTER STP | 68000 | 12.50 | 72 |
| HYRUM | UTAH | HYRUM WWTP | 3800 | 1.00 | 55 |
| MAGNA | UTAH | MAGNA WWTP | 14000 | 1.30 | 43 |
| MORONI | UTAH | MORONI WWTP | 1358 | 1.50 | 60 |
| MURRAY | UTAH | MURRAY STP | 32000 | 4.00 | 59 |
| OGDEN | UTAH | CENTRAL WEBER STP | 132000 | 44.50 | 70 |
| PROVO | UTAH | PROVO WWTP | 60000 | 21.00 | 108 |
| SALT LAKE CITY | UTAH | SALT LK CITY RCL P | 189000 | 45.00 | 69 |
| SALT LAKE CITY | UTAH | SLC SUBURBAN #1 | 155000 | 16.00 | 62 |
| SANDY | UTAH | SANDY CREEK STP | 7800 | 1.30 | 41 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| SOUTH SALT LAKE | UTAH | SOUTH SALT LAKE ST | 7810 | 4.60 | 51 |
| SPRINGVILLE | UTAH | SPRINGVILLE WWTP | 13000 | 4.00 | 40 |
| SYRACUSE | UTAH | NORTH DAVIS CO STP | 77000 | 19.00 | 55 |
| WOODS CROSS | UTAH | S DAVIS CO SD N ST | 35000 | 5.35 | 55 |
| WOODS CROSS | UTAH | S DAVIS CO SD S PL | 13125 | 2.84 | 46 |
| CHARLOTTESVILLE | VIRGINIA | MEADOW CREEK WWTP | 32597 | 4.16 | 67 |
| CHARLOTTESVILLE | VIRGINIA | MOORES CREEK STP | 25000 | 3.30 | 57 |
| CHESTERFIELD | VIRGINIA | FALLING CREEK STP | 49000 | 6.00 | 70 |
| CHESTERFIELD | VIRGINIA | FALLING CREEK STP | 60000 | 6.00 | 74 |
| DANVILLE | VIRGINIA | DANVILLE NORTHSIDE | 108000 | 24.00 | 77 |
| FAIRFAX | VIRGINIA | WESTGATE STP | 140000 | 14.00 | 71 |
| FREDERICKSBURG | VIRGINIA | FREDERICKSBURG STP | 28000 | 3.50 | 68 |
| LEXINGTON | VIRGINIA | LEXINGTON STP | 7600 | 2.00 | 71 |
| MANASSAS PARK | VIRGINIA | UPPER OCCOQUAN WWT | 70000 | 15.00 | 130 |
| NEWPORT NEWS | VIRGINIA | BOAT HARBOR WWTP | 300000 | 22.00 | 67 |
| PETERSBERG | VIRGINIA | PETERSBERG WWTP | 76000 | 15.00 | 79 |
| RICHMOND | VIRGINIA | RICHMOND WWTP | 233000 | 70.00 | 95 |
| RIDGEWAY | VIRGINIA | MARTINSVILLE WPCP | 22000 | 6.00 | 65 |
| ROANOKE | VIRGINIA | ROANOKE WPCP | 170000 | 35.00 | 119 |
| WILLIAMSBURG | VIRGINIA | WILLIAMSBURG WWTP | 45000 | 9.60 | 92 |
| BLAINE | WASHINGTON | WHATCOM CTY DIST # | 10000 | 0.50 | 57 |
| BURLINGTON | WASHINGTON | BURLINGTON WWTP | 3500 | 1.60 | 49 |
| CHEHALIS | WASHINGTON | CHEHALIS TP | 5900 | 7.50 | 89 |
| E WENATCHEE | WASHINGTON | DOUGLAS CO STP #1 | 6000 | 2.30 | 64 |
| EAST WENATCHEE | WASHINGTON | EAST WENATCHEE WWT | 8500 | 1.60 | 59 |
| LONGVIEW | WASHINGTON | COWLITZ WPCP | 45000 | 10.00 | 77 |
| MCCLEARY | WASHINGTON | MCCLEARY STP | 1313 | 0.30 | 42 |
| NACHES | WASHINGTON | NACHES WWTP | 646 | 0.17 | 39 |
| OMAK | WASHINGTON | CITY OF OMAK STP | 4081 | 1.90 | 43 |
| PASCO | WASHINGTON | PASCO WPCP | 17000 | 4.25 | 54 |
| SEDRO WOOLLEY | WASHINGTON | SEDRO WOOLLEY WWTP | 4000 | 1.90 | 51 |
| SELAH | WASHINGTON | SELAH WWTP | 4300 | 4.60 | 56 |
| TOPPENISH | WASHINGTON | TOPPENISH WWTP | 6000 | 1.30 | 51 |
| VANCOUVER | WASHINGTON | SALMON CREEK STP | 13000 | 2.00 | 46 |
| VANCOUVER | WASHINGTON | WESTSIDE STP | 69000 | 12.00 | 94 |
| WAPATO | WASHINGTON | WAPATO WWTP | 3100 | 1.00 | 46 |
| WESTPORT | WASHINGTON | WESTPORT WWTP | 1560 | 1.00 | 49 |
| ATHENS | WEST VIRGINIA | ATHENS WWTP | 2700 | 0.25 | 35 |
| BECKLEY | WEST VIRGINIA | N BECKLEY PUB SERV | 5000 | 0.56 | 31 |
| BELLE | WEST VIRGINIA | BELLE WWTP | 3000 | 0.30 | 33 |
| BELOIT | WISCONSIN | BELOIT STP | 36000 | 9.50 | 81 |
| BROOKFIELD | WISCONSIN | FOX RIVER WPCP | 18000 | 5.00 | 84 |
| GERMANTOWN | WISCONSIN | GERMANTOWN WWTP | 6819 | 1.00 | 56 |
| GRAFTON | WISCONSIN | GRAFTON STP | 8434 | 1.00 | 65 |
| GREEN BAY | WISCONSIN | GREEN BAY METRO ST | 130000 | 52.50 | 100 |
| LACROSSE | WISCONSIN | LACROSSE WWTP | 68428 | 20.00 | 82 |
| MADISON | WISCONSIN | NINE SPRINGS WWTP | 225000 | 57.00 | 84 |
| MADISON | WISCONSIN | NINE SPRINGS WWTP | 240000 | 27.50 | 88 |
| MANITOWOC | WISCONSIN | MANITOWOC WWTP | 34000 | 15.50 | 82 |
| MENASHA | WISCONSIN | NEENAH-MENASHA STP | 39000 | 18.00 | 68 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | DESIGN FLOW IN M.G.D. | ABC RATING |
|---|---|---|---|---|---|
| MENOMONIE | WISCONSIN | MENOMONIE WWTP | 15000 | 2.88 | 74 |
| MERRILL | WISCONSIN | MERRILL WWTP | 9500 | 2.10 | 66 |
| MILWAUKEE | WISCONSIN | SOUTH SHORE WWTP | 212100 | 120.00 | 81 |
| OSHKOSH | WISCONSIN | OSHKOSH WWTP | 54100 | 20.00 | 86 |
| RACINE | WISCONSIN | NORTH PARK STP | 10000 | 1.90 | 59 |
| RICHLAND CENTER | WISCONSIN | RICHLAND CENTER ST | 5100 | 1.60 | 47 |
| ROTHSCHILD | WISCONSIN | ROTHSCHILD STP | 5000 | 1.30 | 86 |
| SO MILWAUKEE | WISCONSIN | SOUTH MILWAUKEE ST | 23487 | 6.00 | 67 |
| STURGEON BAY | WISCONSIN | STURGEON BAY WWTP | 7000 | 1.20 | 72 |
| TOMAH | WISCONSIN | TOMAH STP | 5700 | 1.50 | 70 |
| WATERTOWN | WISCONSIN | WATERTOWN STP | 16000 | 2.50 | 540 |
| WAUKESHA | WISCONSIN | WAUKESHA STP | 49500 | 8.50 | 69 |
| WAUKESHA | WISCONSIN | WAUKESHA STP | 50000 | 8.50 | 66 |
| WAUSAU | WISCONSIN | WAUSAU STP | 40000 | 9.20 | 97 |
| CASPER | WYOMING | CASPER BPU WWTP | 51000 | 6.50 | 68 |
| CHEYENNE | WYOMING | DRY CREEK WWTP | 26000 | 4.50 | 70 |
| EVANSTON | WYOMING | EVANSTON WWTP | 7000 | 1.80 | 44 |
| JACKSON | WYOMING | JACKSON WWTP | 6000 | 0.80 | 38 |
| KEMMERER | WYOMING | KEMMERER WWD | 3700 | 0.50 | 23 |
| RIVERTON | WYOMING | RIVERTON WWTP | 12000 | 1.50 | 51 |
| ROCK SPRINGS | WYOMING | ROCK SPRINGS WWTP | 25950 | 2.00 | 69 |
| TETON VILLAGE | WYOMING | TETON VILLAGE STP | 1212 | 0.20 | 43 |
| THERMOPOLIS | WYOMING | THERMOPOLIS STP | 6300 | 0.60 | 54 |

# TABLE A.2

## LIST OF CONVEYANCE SYSTEMS

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | TOTAL LENGTH OF GRAVITY SEWERS (MI) | TOTAL LENGTH OF FORCE MAIN (MI) |
|---|---|---|---|---|---|
| ALBERTVILLE | ALABAMA | ALBERTVILLE SS | 15000 | 7.0 | 0.0 |
| FOLEY | ALABAMA | FOLEY SS | 4000 | 2.0 | 2.0 |
| GADSDEN | ALABAMA | GADSDEN SS | 46589 | 27.0 | 7.0 |
| HUNTSVILLE | ALABAMA | HUNTSVILLE SS | 300000 | 21.0 | 2.0 |
| JASPER | ALABAMA | JASPER SS | 10000 | 1.0 | 1.0 |
| MONROEVILLE | ALABAMA | MONROEVILLE SS | 5200 | 99999.0 | 10.0 |
| OXFORD | ALABAMA | OXFORD SS | 60000 | 3.0 | 2.0 |
| OZARRK | ALABAMA | OZARK SS | 7500 | 1.7 | 1.6 |
| PHENIX CITY | ALABAMA | PHENIA CITY SS | 26490 | 60.0 | 90.0 |
| FORT SMITH | ARKANSAS | P STREET SS | 22800 | 77.0 | 13.0 |
| GREENBRIAR | ARKANSAS | GREENBRIAR SS | 1400 | 1.9 | 1.1 |
| HARRISON | ARKANSAS | HARRISON SS | 7000 | 0.6 | 0.0 |
| HOT SPRINGS | ARKANSAS | HOT SPRINGS SS | 31500 | 21.0 | 4.8 |
| HUNTSVILLE | ARKANSAS | HUNTSVILLE SS | 1300 | 0.5 | 1.0 |
| JACKSONVILLE | ARKANSAS | JACKSONVILLE SS | 25000 | 7.0 | 14.5 |
| PRAIRIE GROVE | ARKANSAS | PRAIRIE GROVE SS | 1687 | 0.6 | 0.2 |
| ROGERS | ARKANSAS | ROGERS SS | 12000 | 2.0 | 1.3 |
| RUSSELLVILLE | ARKANSAS | RUSSELLVILLE SS | 14000 | 27.0 | 4.0 |
| SPRINGDALE | ARKANSAS | SPRINGDALE SS | 25000 | 5.6 | 3.0 |
| WEST FORK | ARKANSAS | WEST FORK SS | 1000 | 0.0 | 0.0 |
| YELLEVILLE | ARKANSAS | YELLEVILLE SS | 1031 | 0.7 | 0.6 |
| ANDERSON | CALIFORNIA | ANDERSON SS | 6500 | 2.3 | 0.1 |
| BANNING | CALIFORNIA | BANNING SS | 13500 | 0.0 | 0.4 |
| BARSTOW | CALIFORNIA | BARSTOW SS | 17590 | 0.0 | 0.0 |
| BURBANK | CALIFORNIA | BURBANK SS | 83781 | 0.0 | 3.0 |
| CALABASAS | CALIFORNIA | CALABASAS SS | 45000 | 11.0 | 3.0 |
| CAMARILLO | CALIFORNIA | CAMARILLO SEWER SY | 27000 | 21.0 | 0.0 |
| CARMEL | CALIFORNIA | CARMEL SS | 19950 | 54.0 | 6.0 |
| CHICO | CALIFORNIA | CHICO SS | 28000 | 1.4 | 0.4 |
| CORONA | CALIFORNIA | CORONA SS | 58000 | 99999.0 | 0.3 |
| CRESCENT CITY | CALIFORNIA | CRESCENT CITY SS | 3000 | 2.0 | 0.1 |
| DALY CITY | CALIFORNIA | N SAN MATEO C SD S | 86000 | 99999.0 | 2.0 |
| FREMONT | CALIFORNIA | FREMONT SS | 210287 | 7.0 | 0.0 |
| INDIO | CALIFORNIA | INDIO SS | 44765 | 0.4 | 0.5 |
| LIVERMORE | CALIFORNIA | LIVERMORE SS | 50000 | 3.5 | 0.9 |
| LOS ANGELES | CALIFORNIA | LOS ANGELES CO SS | 3800000 | 99999.0 | 99999.0 |
| LOS BANOS | CALIFORNIA | LOS BANOS SS | 10000 | 2.0 | 0.0 |
| MODESTO | CALIFORNIA | MODESTO SS | 101000 | 37.7 | 1.6 |
| OROVILLE | CALIFORNIA | OROVILLE SS | 25000 | 3.5 | 2.7 |
| OXNARD | CALIFORNIA | OXNARD SEWER SYSTE | 93000 | 0.0 | 0.0 |
| PLACERVILLE | CALIFORNIA | PLACERVILLE SS | 6736 | 0.5 | 0.1 |
| RED BLUFF | CALIFORNIA | RED BLUFF SS | 9200 | 99999.0 | 0.0 |
| RICHMOND | CALIFORNIA | RICHMOND SS | 65000 | 99999.0 | 0.0 |
| RIO DELL | CALIFORNIA | RIO DELL SS | 2800 | 99999.0 | 0.3 |
| S SAN FRANCISCO | CALIFORNIA | S SAN FRANCISCO SS | 82000 | 18.0 | 2.0 |
| SAN BERNARDINO | CALIFORNIA | SAN BERNARDINO SS | 172200 | 99999.0 | 99999.0 |
| SAN LORENZO | CALIFORNIA | SAN LORENZO SS | 140000 | 20.0 | 2.0 |
| SANTA PAULA | CALIFORNIA | SANTA PAULA SEWER | 18600 | 0.0 | 0.0 |
| STOCKTON | CALIFORNIA | STOCKTON SS | 138000 | 62.0 | 12.0 |
| THOUSAND OAKS | CALIFORNIA | THOUSAND OAKS SS | 82000 | 0.0 | 0.0 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | TOTAL LENGTH OF GRAVITY SEWERS (MI) | TOTAL LENGTH OF FORCE MAIN (MI) |
|---|---|---|---|---|---|
| THOUSAND OAKS | CALIFORNIA | HILL CANYON TRIBUT | 69500 | 1.8 | 0.0 |
| TURLOCK | CALIFORNIA | TURLOCK SS | 400000 | 99999.0 | 0.0 |
| UKIAH | CALIFORNIA | UKIAH SS | 14500 | 0.1 | 0.4 |
| VALLEJO | CALIFORNIA | VALLEJO SS | 85000 | 99999.0 | 3.7 |
| VENTURA | CALIFORNIA | VENTURA SEWER SYST | 69700 | 21.0 | 0.0 |
| WEST SACRAMENTO | CALIFORNIA | WEST SACRAMENTO SS | 25000 | 0.0 | 12.0 |
| WINDSOR | CALIFORNIA | WINDSOR SS | 5200 | 99999.0 | 0.2 |
| ARVADA | COLORADO | CLEAR CREEK VAL. S | 10000 | 0.0 | 0.0 |
| ASPEN | COLORADO | ASPEN METRO SS | 3500 | 0.0 | 0.0 |
| ASPEN | COLORADO | ASPEN SD SS | 1430 | 0.0 | 0.0 |
| AVON | COLORADO | AVON SS | 15000 | 1.5 | 0.5 |
| BOULDER | COLORADO | BOULDER COLLECTION | 57904 | 0.0 | 0.0 |
| BRIGHTON | COLORADO | BRIGHTON COLL. SYS | 16000 | 1.8 | 0.0 |
| CARBONDALE | COLORADO | CARBONDALE WWTP | 2800 | 0.0 | 0.0 |
| COLORADO SPRING | COLORADO | COLORADO SPRINGS S | 150000 | 0.0 | 0.0 |
| CORTEZ | COLORADO | CORTEZ SS | 7500 | 0.4 | 0.0 |
| DELTA | COLORADO | DELTA SD | 4600 | 0.0 | 0.0 |
| DENVER | COLORADO | S. LAKEWOOD COLL. | 17000 | 0.0 | 0.0 |
| DENVER | COLORADO | N. TABLE MTN. SS | 4500 | 0.0 | 0.0 |
| DURANGO | COLORADO | DURANGO SS | 12000 | 99999.0 | 99999.0 |
| ENGLEWOOD | COLORADO | ENGLEWOOD SS | 40000 | 0.0 | 0.0 |
| ESTES PARK | COLORADO | UPPER THOMPSON SD | 12000 | 3.2 | 0.2 |
| ESTES PARK | COLORADO | ESTES PARK COLLECT | 2500 | 0.0 | 0.0 |
| EVANS | COLORADO | EVANS SAN.DIST.SS | 6000 | 1.3 | 0.0 |
| EVERGREEN | COLORADO | EVERGREEN SS | 4550 | 99999.0 | 0.0 |
| FRISCO | COLORADO | FRISCO SAN DIST SS | 2000 | 0.9 | 0.2 |
| GLENWOOD SPRING | COLORADO | GLENWOOD SPRINGS S | 7350 | 1.1 | 0.0 |
| IDAHO SPRINGS | COLORADO | IDAHO SPRINGS SS | 3000 | 0.2 | 0.0 |
| LONGMONT | COLORADO | LONGMONT SS | 45000 | 0.0 | 0.0 |
| LOUISVILLE | COLORADO | LOUISVILLE SD | 5700 | 1.7 | 3.4 |
| LOVELAND | COLORADO | LOVELAND | 35000 | 1.4 | 2.4 |
| MEEKER | COLORADO | MEEKER SD | 2350 | 0.0 | 0.0 |
| MONTROSE | COLORADO | MONTROSE SS | 8500 | 99999.0 | 0.0 |
| NEDERLAND | COLORADO | NEDERLAND SD | 8500 | 0.0 | 0.0 |
| PAGOSA SPRINGS | COLORADO | PAGOSA SPRINGS SS | 1500 | 0.1 | 0.0 |
| RIFLE | COLORADO | RIFLE SD | 3000 | 0.0 | 0.0 |
| SALIDA | COLORADO | SALIDA SS | 6000 | 0.0 | 0.0 |
| TRINIDAD | COLORADO | TRINIDAD SS | 10000 | 1.4 | 0.2 |
| VAIL | COLORADO | VAIL COLL. | 2500 | 0.0 | 0.0 |
| WESTMINSTER | COLORADO | WESTMINSTER COLL. | 32000 | 7.1 | 0.0 |
| WINDSOR | COLORADO | WINDSOR COLLECTION | 5000 | 0.0 | 0.0 |
| ENFIELD | CONNECTICUT | ENFIELD WPCP | 48000 | 13.9 | 5.0 |
| FAIRFIELD | CONNECTICUT | FAIRFIELD SS | 46000 | 4.5 | 0.8 |
| GROTON | CONNECTICUT | GROTON SS | 15000 | 6.9 | 3.8 |
| LITCHFIELD | CONNECTICUT | LITCHFIELD SS | 5700 | 0.0 | 0.0 |
| MANCHESTER | CONNECTICUT | MANCHESTER SS | 46600 | 0.6 | 99999.0 |
| SALISBURY | CONNECTICUT | TWN OF SALISBURY S | 2400 | 1.1 | 1.2 |
| SEYMOUR | CONNECTICUT | SEYMOUR SS | 10000 | 2.7 | 0.7 |
| STAMFORD | CONNECTICUT | STAMFORD WPCF | 90000 | 15.2 | 99999.0 |
| TORRINGTON | CONNECTICUT | TORRINGTON WPCF | 28500 | 4.3 | 3.2 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | TOTAL LENGTH OF GRAVITY SEWERS (MI) | TOTAL LENGTH OF FORCE MAIN (MI) |
|---|---|---|---|---|---|
| VERNON | CONNECTICUT | VERNON SS | 25000 | 4.9 | 5.0 |
| WAREHOUSE PT | CONNECTICUT | EAST WINDSOR SS | 2400 | 2.3 | 0.7 |
| WEST HAVEN | CONNECTICUT | WEST HAVEN SS | 52000 | 56.4 | 5.4 |
| WILLIMANTIC | CONNECTICUT | WILLIMANTIC SS | 20000 | 0.1 | 0.1 |
| GEORGETOWN | DELAWARE | GEORGETOWN SS | 3000 | 3.5 | 3.0 |
| HARRINGTON | DELAWARE | HARRINGTON SS | 2500 | 2.9 | 1.5 |
| MIDDLETOWN | DELAWARE | MIDDLETOWN SS | 2900 | 1.8 | 0.5 |
| SHELBYVILLE | DELAWARE | SHELBYVILLE SS | 1400 | 0.7 | 1.1 |
| BARTOW | FLORIDA | LAKELAND SS (BARTO | 23000 | 6.5 | 0.0 |
| BOCA RATON | FLORIDA | BOCA RATON SEWERS | 35000 | 54.4 | 73.0 |
| FT.PIERCE | FLORIDA | FT.PIERCE CITY OF | 33000 | 67.0 | 16.0 |
| GOULDS | FLORIDA | GOULDS COLL. | 20000 | 22.0 | 0.0 |
| HOLLY HILL | FLORIDA | HOLLY HILL SS | 10000 | 0.0 | 3.0 |
| JACKSON.BEACH | FLORIDA | JACKSONVILLE BEACH | 17700 | 7.0 | 10.0 |
| KISSIMMEE | FLORIDA | KISSIMMEE 192 STP | 2000 | 6.0 | 0.0 |
| LAKELAND | FLORIDA | LAKELAND SS | 63000 | 0.0 | 0.0 |
| MIAMI | FLORIDA | VIRGINIA KEYS COLL | 400000 | 51.6 | 250.0 |
| OCALA | FLORIDA | OCALA STP #1 SS | 13500 | 0.0 | 25.0 |
| PENSACOLA | FLORIDA | PENSACOLA SS | 25000 | 0.0 | 0.0 |
| PINELLAS PARK | FLORIDA | PINELLAS PARK SS | 0 | 12.5 | 0.0 |
| SARASOTA | FLORIDA | SARASOTA SS | 54000 | 15.0 | 48.0 |
| ST. PETERBURG | FLORIDA | ST.PETERSBURG SS | 236140 | 57.0 | 0.0 |
| ST.AUGUSTINE | FLORIDA | ST.AUGUSTINE SS | 21200 | 28.0 | 12.0 |
| TALLAHASSEE | FLORIDA | TALLAHASSEE SS | 85000 | 128.0 | 0.0 |
| TARPON SPRINGS | FLORIDA | TARPON SPRINGS SS | 15000 | 7.0 | 0.0 |
| TITUSVILLE | FLORIDA | SOUTH STP SS | 10000 | 54.0 | 113.0 |
| BRUNSWICK | GEORGIA | BRUNSWICK SS | 35000 | 0.0 | 10.0 |
| THOMASVILLE | GEORGIA | THOMASVILLE WPCP | 19095 | 4.3 | 0.0 |
| ABERDEEN | IDAHO | ABERDEEN SS | 1640 | 99999.0 | 0.1 |
| BOISE | IDAHO | BOISE SS | 108079 | 8.0 | 99999.0 |
| IDAHO FALLS | IDAHO | IDAHO FALLS SS | 50000 | 99999.9 | 0.3 |
| MERIDIAN | IDAHO | MERIDIAN SS | 6654 | 0.5 | 3.8 |
| SODA SPRINGS | IDAHO | SODA SPRINGS SS | 4051 | 3.0 | 0.3 |
| TWIN FALLS | IDAHO | TWIN FALLS SS | 25000 | 7.3 | 0.5 |
| MT CARROLL | ILLINOIS | MT CARROLL SS | 2100 | 0.5 | 0.1 |
| WHEATON | ILLINOIS | WHEATON SS | 53000 | 0.9 | 0.2 |
| ANKENY | IOWA | WESTWOOD PLANT #4S | 4590 | 0.3 | 0.0 |
| ANKENY | IOWA | WEST PLANT #2 SS | 10000 | 0.3 | 0.0 |
| ANKENY | IOWA | SE PLANT #3 SS | 12000 | 1.6 | 0.0 |
| CAMANCHE | IOWA | CAMANCHE SS | 4200 | 1.3 | 0.6 |
| CEDAR FALLS | IOWA | CEDAR FALLS SS | 35472 | 10.7 | 3.8 |
| CORALVILLE | IOWA | CORALVILLE SS | 6928 | 3.8 | 5.0 |
| EMMETSBURG | IOWA | EMMETSBURG SS | 4450 | 99999.0 | 0.8 |
| ESTHERVILLE | IOWA | ESTHERVILLE SS | 8108 | 5.3 | 3.0 |
| FORT DODGE | IOWA | FORT DODGE SS | 28000 | 7.9 | 2.0 |
| GRIMES | IOWA | GRIMES SS | 1985 | 0.0 | 0.0 |
| INDIANOLA | IOWA | INDIANOLA N. SS | 8000 | 1.3 | 2.0 |
| INDIANOLA | IOWA | INDIANOLA S. SS | 3000 | 0.4 | 0.6 |
| IOWA CITY | IOWA | IOWA CITY SS | 50000 | 10.0 | 99999.0 |
| NEWTON | IOWA | NEWTON SOUTHWEST S | 4145 | 0.0 | 0.0 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | TOTAL LENGTH OF GRAVITY SEWERS (MI) | TOTAL LENGTH OF FORCE MAIN (MI) |
|---|---|---|---|---|---|
| NEWTON | IOWA | NEWTON NORTHWEST S | 3141 | 0.0 | 0.0 |
| NEWTON | IOWA | NEWTON SOUTH SS | 6898 | 1.5 | 0.7 |
| OSKALOOSA | IOWA | OSKALOOSA SS | 11000 | 1.7 | 3.0 |
| REINBECK | IOWA | REINBECK SS | 1711 | 0.2 | 0.1 |
| WATERLOO | IOWA | WATERLOO SS | 75000 | 99999.0 | 99999.0 |
| ANTHONY | KANSAS | ANTHONY SS | 2771 | 0.7 | 0.3 |
| DE SOTO | KANSAS | DE SOTO SS | 2000 | 0.6 | 0.5 |
| EMPORIA | KANSAS | EMPORIA SS | 30000 | 7.1 | 4.9 |
| LENEXA | KANSAS | LENEXA SS | 10000 | 1.2 | 0.4 |
| MANHATTAN | KANSAS | MANHATTAN SS | 40000 | 7.1 | 1.5 |
| NEWTON | KANSAS | NEWTON SS | 17000 | 0.4 | 0.1 |
| TOPEKA | KANSAS | TOPEKA SS | 150000 | 99999.0 | 2.0 |
| WICHITA | KANSAS | WICHITA SS | 300000 | 14.8 | 3.0 |
| BOWLING GREEN | KENTUCKY | BOWLING GREEN SS | 53000 | 3.5 | 4.0 |
| CADIZ | KENTUCKY | CADIZ SS | 2200 | 1.5 | 0.0 |
| HOPKINSVILLE | KENTUCKY | HOPKINSVILLE SS | 29000 | 4.0 | 11.0 |
| MT WASHINGTON | KENTUCKY | MT WASHINGTON SS | 3080 | 1.5 | 3.0 |
| RUSSELLVILLE | KENTUCKY | RUSSELLVILLE SS | 9394 | 0.1 | 5.0 |
| ALEXANDRIA | LOUISIANA | ALEXANDRIA SS | 53000 | 99999.0 | 25.0 |
| BOGALUSA | LOUISIANA | BOGALUSA SS | 18412 | 16.0 | 2.0 |
| KENNER | LOUISIANA | KENNER SS | 66500 | 99999.0 | 35.0 |
| LAFAYETTE | LOUISIANA | LAFAYETTE SS | 89689 | 63.0 | 28.0 |
| SHREVEPORT | LOUISIANA | SHREVEPORT SS | 215000 | 100.0 | 28.0 |
| BRUNSWICK | MAINE | BRUNSWICK SS | 13000 | 0.0 | 0.0 |
| ACCOKEEK | MARYLAND | PISCATAWAY | 104000 | 33.5 | 1.9 |
| BOWIE | MARYLAND | BOWIE-BELAIR SS | 32500 | 0.0 | 2.5 |
| EASTON | MARYLAND | EASTON SS | 8000 | 12.9 | 7.6 |
| HAGERSTOWN | MARYLAND | HAGERSTOWN SS | 35800 | 0.0 | 0.0 |
| LAUREL | MARYLAND | PARKWAY BASIN SS | 33800 | 8.0 | 0.8 |
| MANCHESTER | MARYLAND | MANCHESTER SS | 1500 | 0.0 | 0.6 |
| THURMONT | MARYLAND | THURMONT SS | 3000 | 0.0 | 1.0 |
| UPPER MARLBORO | MARYLAND | WESTERN BRANCH WWT | 75400 | 0.3 | 0.5 |
| AMESBURY | MASSACHUSETTS | AMESBURY SS | 12500 | 2.9 | 8.0 |
| BELLERICA | MASSACHUSETTS | BELLERICA SS | 12000 | 0.0 | 14.0 |
| DOUGLAS | MASSACHUSETTS | DOUGLAS SS | 2100 | 0.1 | 0.5 |
| MANCHESTER | MASSACHUSETTS | MANCHESTER SS | 3500 | 0.0 | 0.8 |
| ROCKPORT | MASSACHUSETTS | ROCKPORT SS | 4500 | 7.8 | 4.0 |
| FLINT | MICHIGAN | GENESSE COUNTY SS | 200000 | 18.0 | 3.0 |
| FRANKENMUTH | MICHIGAN | FRANKENMUTH SS | 3800 | 0.4 | 1.0 |
| GRANDVILLE | MICHIGAN | GRANDVILLE SS | 18000 | 1.0 | 0.0 |
| HARBOR SPRINGS | MICHIGAN | HARBOR SPRINGS SS | 5500 | 10.0 | 11.0 |
| HASTINGS | MICHIGAN | HASTINGS S S | 6500 | 0.0 | 0.1 |
| IONIA | MICHIGAN | IONIA SS | 12000 | 4.0 | 0.5 |
| PETERSBURG | MICHIGAN | PETERSBURG WWTP | 1200 | 2.0 | 2.0 |
| PINCONNING | MICHIGAN | PINCUNNING SS | 1500 | 0.8 | 0.0 |
| PORT HURON | MICHIGAN | PORT HURON SS | 55000 | 88.0 | 1.0 |
| TRAVERSE CITY | MICHIGAN | TRAVERSE | 21000 | 8.0 | 4.0 |
| TRENTON | MICHIGAN | TRENTON SS | 25000 | 31.0 | 4.0 |
| WARREN | MICHIGAN | WARREN SS | 167000 | 48.0 | 0.0 |
| WYOMING | MICHIGAN | WYOMING SS | 100000 | 4.0 | 1.0 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | TOTAL LENGTH OF GRAVITY SEWERS (MI) | TOTAL LENGTH OF FORCE MAIN (MI) |
|---|---|---|---|---|---|
| ZEELAND | MICHIGAN | ZEELAND SS | 5200 | 2.0 | 4.0 |
| ALEXANDRIA | MINNESOTA | ALEXANDRIA SS | 12000 | 99999.0 | 29.0 |
| AUSTIN | MINNESOTA | AUSTIN SS | 26000 | 14.6 | 4.0 |
| DETROIT LAKES | MINNESOTA | DETROIT LAKES SS | 7500 | 5.3 | 99999.0 |
| ELK RIVER | MINNESOTA | ELK RIVER SS | 2400 | 1.6 | 0.3 |
| FARIBAULT | MINNESOTA | FARIBAULT SS | 16000 | 6.6 | 0.6 |
| MANKATO | MINNESOTA | MANKATO SS | 45000 | 7.5 | 1.5 |
| MOORHEAD | MINNESOTA | MOORHEAD SS | 35000 | 19.6 | 5.0 |
| NORTHFIELD | MINNESOTA | NORTHFIELD SS | 12783 | 1.5 | 0.2 |
| ROCHESTER | MINNESOTA | ROCHESTER SS | 70000 | 3.7 | 1.4 |
| TWO HARBORS | MINNESOTA | TWO HARBORS SS | 4437 | 99999.0 | 99999.0 |
| WILLMAR | MINNESOTA | WILLMAR SS | 20000 | 9.9 | 1.0 |
| WINONA | MINNESOTA | WINONA SS | 25000 | 24.0 | 3.5 |
| GREENVILLE | MISSISSIPPI | GREENVILLE SS | 55000 | 0.0 | 0.0 |
| HATTIESBURG | MISSISSIPPI | HATTIESBURG SS | 45000 | 0.0 | 1.0 |
| PICAYUNE | MISSISSIPPI | PICAYNE SS | 12000 | 0.0 | 0.0 |
| COLUMBIA | MISSOURI | COLUMBIA COLLECTOR | 59850 | 2.3 | 0.0 |
| MEXICO | MISSOURI | MEXICO COLL. | 13000 | 1.4 | 0.0 |
| BELLEVUE | NEBRASKA | BELLEVUE SS | 10500 | 9.9 | 2.5 |
| COLUMBUS | NEBRASKA | COLUMBUS | 18000 | 2.7 | 2.0 |
| FALLS CITY | NEBRASKA | FALLS CITY SS | 5440 | 0.5 | 0.9 |
| FREMONT | NEBRASKA | FREMONT SS | 26000 | 0.0 | 0.0 |
| GIBBON | NEBRASKA | GIBBON SS | 1500 | 0.3 | 0.0 |
| GRAND ISLAND | NEBRASKA | GRAND ISLAND SS | 32000 | 8.5 | 3.3 |
| HASTINGS | NEBRASKA | HASTINGS SS | 25000 | 99999.0 | 0.0 |
| KEARNEY | NEBRASKA | KEARNEY SS | 30000 | 1.2 | 0.8 |
| LINCOLN | NEBRASKA | LINCOLN SS | 180000 | 10.3 | 0.0 |
| NEWMAN GROVE | NEBRASKA | NEWMAN GROVE SS | 863 | 0.0 | 0.0 |
| SUPERIOR | NEBRASKA | SUPERIOR SS | 3512 | 4.7 | 0.3 |
| YORK | NEBRASKA | YORK SS | 7500 | 0.4 | 0.1 |
| BAYVILLE | NEW JERSEY | OCEAN COUNTY SS | 240273 | 0.0 | 40.0 |
| BELFORD | NEW JERSEY | TWP MIDDLFTOWN SS | 65000 | 3.0 | 6.0 |
| BIRMINGHAM | NEW JERSEY | PEMBERTON TWP SS | 14000 | 24.0 | 6.0 |
| BRIDGEPORT | NEW JERSEY | LOGAN TWP SS | 2300 | 0.0 | 10.0 |
| EAST WINDSOR | NEW JERSEY | E WINDSOR MUA SS | 22000 | 1.5 | 6.0 |
| ELIZABETH | NEW JERSEY | JOINT MEETING SS | 500000 | 0.0 | 0.0 |
| HACKETTSTOWN | NEW JERSEY | HACKETTSTOWN SS | 13600 | 0.0 | 0.0 |
| LAMBERTVILLE | NEW JERSEY | LAMBERTVILLE SS | 7000 | 0.9 | 0.7 |
| LAWRENCEVILLE | NEW JERSEY | EWING-LAWRENCE SS | 65000 | 21.0 | 20.0 |
| LONG BRANCH | NEW JERSEY | LONG BRANCH SS | 34000 | 12.0 | 1.0 |
| LONGVVALLEY | NEW JERSEY | WASHINGTON TWP SS | 2412 | 0.4 | 2.0 |
| MARTON | NEW JERSEY | EVESTROM TWP SS | 20000 | 4.0 | 2.0 |
| MATAWAN | NEW JERSEY | ABERDEEN TWP SS | 17420 | 5.0 | 2.0 |
| MEDFORD | NEW JERSEY | MEDFORD TWP SS | 15500 | 3.0 | 7.0 |
| OAKHURST | NEW JERSEY | TWP OF OCEAN SS | 35000 | 9.0 | 3.0 |
| SAYREVILLE | NEW JERSEY | MIDDLESEX CO SS | 600000 | 120.0 | 4.0 |
| TOMS RIVER | NEW JERSEY | DOVER SEW AUTH SS | 60000 | 8.0 | 18.0 |
| WILLINGBORO | NEW JERSEY | WILLINGBORO SS | 56450 | 5.0 | 2.0 |
| LAS VEGAS | NEW MEXICO | LAS VEGAS SS | 14000 | 0.0 | 0.2 |
| RATON | NEW MEXICO | RATON SS | 9000 | 0.7 | 0.4 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | TOTAL LENGTH OF GRAVITY SEWERS (MI) | TOTAL LENGTH OF FORCE MAIN (MI) |
|---|---|---|---|---|---|
| TAOS | NEW MEXICO | TAOS SS | 3000 | 0.0 | 0.0 |
| AMHERST | NEW YORK | AMHERST S.S. | 60000 | 25.0 | 0.0 |
| APALACHIN | NEW YORK | OWEGO # 2 S.S. | 7500 | 10.0 | 1.5 |
| BATAVIA | NEW YORK | BATAVIA S.S. | 19500 | 12.0 | 0.0 |
| BATH | NEW YORK | BATH S.S. | 6530 | 0.1 | 0.0 |
| CANTON | NEW YORK | CANTON SEW SYS | 10000 | 1.2 | 0.0 |
| CAYUGA HGTS | NEW YORK | CAYUGA HGTS S.S. | 7200 | 0.0 | 0.0 |
| DELMAR | NEW YORK | BETHLEHEM S.S. | 18000 | 23.6 | 11.0 |
| E.ROCKAWAY | NEW YORK | SEWAGE DIS.DIST NO | 558400 | 47.0 | 2.5 |
| ELMIRA | NEW YORK | CHEMUNG CO SD #1 S | 16090 | 2.2 | 0.3 |
| JAMESTOWN | NEW YORK | JAMESTOWN S.S. | 40000 | 43.0 | 1.0 |
| LOWVILLE | NEW YORK | LOWVILLE SEW.SYS | 3800 | 1.0 | 0.0 |
| ORANGEBURG | NEW YORK | ORANGETOWN SEW SYS | 70000 | 25.0 | 0.0 |
| OYSTER BAY | NEW YORK | OYSTER BAY S.S. | 7500 | 1.6 | 0.0 |
| PENN YAN | NEW YORK | PENN YAN S.S | 5200 | 0.5 | 0.0 |
| POUGHKEEPSIE | NEW YORK | ARLINGTON SEW SYS | 23000 | 11.0 | 0.0 |
| SARANAC LAKE | NEW YORK | SARANAC LAKE SEW S | 10000 | 12.0 | 0.0 |
| SPENCERPORT | NEW YORK | SPENCERPORT S.S. | 5000 | 0.0 | 0.0 |
| STONY POINT | NEW YORK | STONY POINT SEW SY | 9000 | 1.0 | 0.0 |
| SUFFERN | NEW YORK | SEWER SYSTEM | 11000 | 2.2 | 0.0 |
| WEBSTER | NEW YORK | WEBSTER S.S. | 7000 | 0.0 | 0.0 |
| ALBEMARLE | NORTH CAROLINA | LONG CREEK SS | 14000 | 0.5 | 1.0 |
| GREENSBORO | NORTH CAROLINA | GREENSBORO SS | 196000 | 23.0 | 14.0 |
| GREENVILLE | NORTH CAROLINA | GREENVILLE WWTP | 33000 | 99999.0 | 3.2 |
| MAXTON | NORTH CAROLINA | MAXTON WWTP | 2500 | 99999.0 | 0.0 |
| PEMBROKE | NORTH CAROLINA | PEMBROKE WWTP | 4000 | 0.0 | 0.7 |
| RALEIGH | NORTH CAROLINA | RALEIGH SS | 188334 | 45.0 | 0.0 |
| ROCKINGHAM | NORTH CAROLINA | ROCKINGHAM SS | 10100 | 17.2 | 3.4 |
| WASHINGTON | NORTH CAROLINA | WASHINGTON MUM WTP | 8900 | 2.5 | 7.0 |
| BARBERTON | OHIO | BARBERTON SS | 35300 | 0.0 | 0.0 |
| BEDFORD | OHIO | BEDFORD SS | 16500 | 0.0 | 0.0 |
| BELLEFONTAINE | OHIO | BELLEFONTAINE SS | 13000 | 0.8 | 1.1 |
| COLUMBUS | OHIO | COLUMBUS SEWERAGE | 865000 | 0.0 | 0.0 |
| DAYTON | OHIO | DAYTON SEWERS | 317000 | 0.0 | 0.0 |
| HEATH | OHIO | HEATH SS | 8020 | 2.5 | 3.1 |
| LOGAN | OHIO | LOGAN SS | 6000 | 1.2 | 2.0 |
| NEWARK | OHIO | NEWARK SEWERS | 43000 | 0.0 | 0.0 |
| RAVENNA | OHIO | RAVENNA SS | 12000 | 0.0 | 0.0 |
| SIDNEY | OHIO | SIDNEY SEWERAGE SY | 17000 | 5.9 | 0.0 |
| SIDNEY | OHIO | SIDNEY SS | 18000 | 6.4 | 1.0 |
| TROY | OHIO | TROY SS | 18000 | 11.6 | 1.0 |
| BLACKWELL | OKLAHOMA | BLACKWELL SS | 8645 | 0.2 | 0.0 |
| HENRYETTA | OKLAHOMA | HENRYETTA SS | 7500 | 99999.0 | 0.4 |
| IDABEL | OKLAHOMA | IDABEL SS | 12000 | 2.0 | 11.0 |
| MUSKOGEE | OKLAHOMA | MUSKOGEE SS | 40000 | 26.5 | 1.6 |
| NORMAN | OKLAHOMA | NORMAN SS | 63000 | 2.0 | 8.0 |
| OKLAHOMA CITY | OKLAHOMA | OKLAHOMA CITY SS | 500000 | 6.0 | 2.0 |
| OKMULGEE | OKLAHOMA | OKMULGEE SS | 20000 | 2.8 | 2.0 |
| PONCA CITY | OKLAHOMA | PONCA CITY SS | 30000 | 3.3 | 0.5 |
| TULSA | OKLAHOMA | TULSA SS | 380071 | 162.0 | 3.0 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | TOTAL LENGTH OF GRAVITY SEWERS (MI) | TOTAL LENGTH OF FORCE MAIN (MI) |
|---|---|---|---|---|---|
| CLATSKANIE | OREGON | CLATSKANIE SS | 1700 | 0.0 | 0.6 |
| COTTAGE GROVE | OREGON | COTTAGE GROVE SS | 7500 | 2.1 | 0.5 |
| DALLAS | OREGON | DALLAS SS | 9000 | 3.2 | 2.0 |
| DEPOE BAY | OREGON | DEPOE BAY SS | 1650 | 8.9 | 0.3 |
| EUGENE | OREGON | EUGENE SS | 106000 | 99999.0 | 0.0 |
| FOREST GROVE | OREGON | FOREST GROVE SS | 19347 | 6.6 | 0.5 |
| HILLSBORO | OREGON | HILLSBORO WEST SS | 7765 | 0.0 | 0.0 |
| HILLSBORO | OREGON | HILLSBORO SS | 100747 | 99999.0 | 99999.0 |
| OTTER ROCK | OREGON | OTTER CREST INN SS | 600 | 0.5 | 0.3 |
| PORTLAND | OREGON | INVERNESS SS | 10829 | 14.0 | 99999.0 |
| SALEM | OREGON | SALEM SS | 138500 | 0.0 | 99999.0 |
| THE DALLES | OREGON | THE DALLES SS | 16075 | 1.1 | 2.0 |
| TIGARD | OREGON | TIGARD SS | 120000 | 99999.0 | 99999.0 |
| TILLAMOOK | OREGON | TILLAMOOK SS | 4300 | 4.2 | 1.3 |
| ALLENTOWN | PENNSYLVANIA | KLINE'S ISLAND WWT | 179000 | 0.0 | 0.0 |
| BETHLEHEM | PENNSYLVANIA | BETHLEHEM WWTP | 100000 | 0.0 | 0.0 |
| CENTER VALLEY | PENNSYLVANIA | UPPER SAUCON TWP W | 9000 | 1.0 | 1.4 |
| CHAMBERSBURG | PENNSYLVANIA | CHAMBERSBURG WWTP | 17000 | 0.8 | 0.8 |
| HATFIELD | PENNSYLVANIA | HATFIELD TWP AWT | 10000 | 0.0 | 1.0 |
| HERSHEY | PENNSYLVANIA | DERRY TOWNSHIP SS | 20000 | 4.1 | 2.9 |
| LEBANON | PENNSYLVANIA | LEBANON SS | 32300 | 0.6 | 0.2 |
| LEMOYNE | PENNSYLVANIA | LEMOYNE BORO JT. A | 16500 | 4.3 | 3.0 |
| LITITZ | PENNSYLVANIA | LITITZ STP | 7600 | 0.0 | 0.0 |
| MECHANICSBURG | PENNSYLVANIA | MECHANICSBURG STP | 9500 | 2.6 | 3.0 |
| POTTSTOWN | PENNSYLVANIA | POTTSTOWN SS | 33000 | 3.1 | 2.7 |
| SPRINGETTSBURY | PENNSYLVANIA | SPRINGETTSBURY TWP | 48000 | 7.4 | 0.3 |
| WILLOW GROVE | PENNSYLVANIA | U MORELAND-HATBORO | 30000 | 1.0 | 2.5 |
| EAST PROVIDENCE | RHODE ISLAND | EAST PROVIDENCE SS | 40000 | 13.8 | 10.0 |
| WARWICK | RHODE ISLAND | WARWICK SS | 13500 | 0.0 | 4.5 |
| BATESBURG | SOUTH CAROLINA | BATESBURG SS | 4500 | 99999.0 | 4.5 |
| COLUMBIA | SOUTH CAROLINA | COLUMBIA SS | 200000 | 30.0 | 10.0 |
| ROCK HILL | SOUTH CAROLINA | ROCK HILL SS | 32127 | 19.8 | 5.0 |
| UNION | SOUTH CAROLINA | UNION SS | 11000 | 0.7 | 1.2 |
| CUSTER | SOUTH DAKOTA | CUSTER SS | 2200 | 0.0 | 0.0 |
| RAPID CITY | SOUTH DAKOTA | RAPID CITY SS | 60000 | 1.2 | 1.4 |
| YANKTON | SOUTH DAKOTA | YANKTON SS | 15000 | 5.8 | 1.3 |
| CENTERVILLE | TENNESSEE | CENTERVILLE SS | 2495 | 1.6 | 0.6 |
| CLEVELAND | TENNESSEE | CLEVELAND SS | 30000 | 1.8 | 2.6 |
| DICKSON | TENNESSEE | DICKSON COLL SYS | 9000 | 2.2 | 1.3 |
| FAYETTEVILLE | TENNESSEE | FAYETTEVILLE SS | 8500 | 2.1 | 3.2 |
| FRANKIN | TENNESSEE | FRANKLIN SS | 10500 | 5.0 | 4.0 |
| HUNTINGDON | TENNESSEE | HUNTINGDON SS | 4500 | 1.0 | 0.0 |
| KNOXVILLE | TENNESSEE | KNOXVILLE SS | 163794 | 42.5 | 20.0 |
| MARYVILLE | TENNESSEE | MARYVILLE SS | 5008 | 0.0 | 2.5 |
| NASHVILLE | TENNESSEE | WHITES CREEK SS | 50000 | 31.6 | 12.0 |
| NASHVILLE | TENNESSEE | DRY CREEK SS | 25000 | 4.3 | 11.0 |
| ATHENS | TEXAS | ATHENS N COLL SYS | 4000 | 0.9 | 0.1 |
| ATHENS | TEXAS | ATHENS W COLL SYS | 9200 | 2.3 | 1.7 |
| ATHENS | TEXAS | ATHENS WEST SS | 9200 | 2.3 | 1.7 |
| ATHENS | TEXAS | ATHENS NORTH SS | 4000 | 0.4 | 0.1 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | TOTAL LENGTH OF GRAVITY SEWERS (MI) | TOTAL LENGTH OF FORCE MAIN (MI) |
|---|---|---|---|---|---|
| BAYTOWN | TEXAS | EAST DISTRICT SS | 24000 | 87.0 | 99999.0 |
| BAYTOWN | TFXAS | CENTRAL DIST SS | 24450 | 205.0 | 99999.0 |
| BROWNSVILLE | TEXAS | BROWNSVILLE COLL S | 48135 | 0.0 | 0.0 |
| CONROE | TEXAS | CONROE SS | 30000 | 99999.0 | 10.0 |
| COPPELL | TEXAS | SEWAGE COLLECTORS | 825 | 0.0 | 0.0 |
| EVLESS | TEXAS | EVLESS W&S SYSTEM | 27000 | 3.0 | 0.0 |
| GALVESTON | TFXAS | SEWAGE COLLECTION | 60000 | 21.0 | 0.0 |
| GEORGETOWN | TEXAS | GEORGETOWN WWTP | 10000 | 0.8 | 4.0 |
| HITCHCOCK | TEXAS | HITCHCOCK SS | 5700 | 0.5 | 2.0 |
| HUNTSVILLE | TEXAS | HUNTSVILLF SS | 23000 | 99999.0 | 8.0 |
| IRVING | TEXAS | IRVING COLLECTION | 115244 | 5.0 | 0.0 |
| LEWISVILLE | TEXAS | WW COLLECTION SYS | 23000 | 6.0 | 5.0 |
| PORT ARTHUR | TEXAS | PORT ARTHUR SS | 69000 | 44.0 | 9.0 |
| TEXAS CITY | TEXAS | TEXAS CITY SS | 43000 | 99999.0 | 0.5 |
| COTTONWOOD | UTAH | COTTONWOOD SS | 80000 | 0.2 | 0.3 |
| PROVO | UTAH | PROVO SS | 60000 | 0.0 | 0.0 |
| SALT LAKE CITY | UTAH | SLC SUBURBAN SS | 151000 | 1.7 | 1.0 |
| CHESTERFIELD | VIRGINIA | CHESTERFIELD CO SS | 60000 | 10.5 | 14.0 |
| DANVILLE | VIRGINIA | DANVILLE SEW SYS | 108000 | 99999.0 | 3.0 |
| FREDERICKSBURG | VIRGINIA | FREDERICKSBURG SS | 28000 | 0.0 | 35.0 |
| LEXINGTON | VIRGINIA | LEXINGTON SS | 7600 | 0.5 | 0.3 |
| MANASSAS PARK | VIRGINIA | UPPER OCCOQUAN SD | 70000 | 0.0 | 6.0 |
| PETERSBERG | VIRGINIA | PETERSBERG SS | 76000 | 34.0 | 10.0 |
| PORTSMOUTH | VIRGINIA | PINNER'S POINT SS | 92393 | 199.0 | 0.0 |
| RIDGEWAY | VIRGINIA | MARTINSVILLE SD | 22000 | 0.0 | 0.0 |
| BELLEVUE | WASHINGTON | BELLEVUE COLL SYS | 18228 | 0.0 | 0.0 |
| BLAINE | WASHINGTON | WHATCOM CTY DIST # | 10000 | 13.2 | 1.5 |
| BOTHELL | WASHINGTON | BOTHELL COLL SYS | 5120 | 0.0 | 0.0 |
| BURLINGTON | WASHINGTON | BURLINGTON SS | 3500 | 12.0 | 3.0 |
| EAST WENATCHEE | WASHINGTON | EAST WENATCHEE SS | 8500 | 0.0 | 0.0 |
| OMAK | WASHINGTON | CITY OF OMAK SS | 4081 | 0.5 | 0.0 |
| PASCO | WASHINGTON | PASCO SS | 17000 | 7.1 | 1.0 |
| SEDRO WOOLLEY | WASHINGTON | SEDRO WOOLLEY SS | 4000 | 0.2 | 0.5 |
| SELAH | WASHINGTON | SELAH SS | 4300 | 2.8 | 1.5 |
| TUKWILA | WASHINGTON | TUKWILA COLL SYS | 3000 | 0.0 | 0.0 |
| WESTPORT | WASHINGTON | WESTPORT SS | 1560 | 9.8 | 8.8 |
| BECKLEY | WEST VIRGINIA | N BECKLEY PUB SERV | 5000 | 99999.0 | 1.6 |
| BELLE | WEST VIRGINIA | BELLE SD | 3000 | 99999.0 | 4.0 |
| GLENVILLE | WEST VIRGINIA | GLENVILLE SD | 2900 | 99999.0 | 0.5 |
| BROOKFIELD | WISCONSIN | FOX RIVER SS | 18000 | 99999.0 | 99999.0 |
| GERMANTOWN | WISCONSIN | GERMANTOWN SS | 6819 | 3.3 | 4.0 |
| GRAFTON | WISCONSIN | GRAFTON SEWERS | 8434 | 4.5 | 0.0 |
| JANESVILLE | WISCONSIN | JANESVILLF SS | 50000 | 0.0 | 0.0 |
| LACROSSE | WISCONSIN | LACROSSE SS | 68428 | 99999.0 | 5.0 |
| MADISON | WISCONSIN | MADISON SS | 225000 | 208.0 | 22.0 |
| MANITOWOC | WISCONSIN | MANITOWOC SS | 34000 | 1.8 | 0.7 |
| MENOMONIE | WISCONSIN | MENOMONIE SS | 15000 | 2.9 | 0.5 |
| MERRILL | WISCONSIN | MERRILL SS | 9500 | 0.0 | 0.0 |
| MILWAUKEE | WISCUNSIN | SOUTH SHORE SS | 212100 | 37.5 | 0.7 |
| OSHKOSH | WISCONSIN | OSHKOSH SS | 54100 | 17.0 | 4.6 |

| CITY | STATE | FACILITY NAME | SERVICE POPULATION | TOTAL LENGTH OF GRAVITY SEWERS (MI) | TOTAL LENGTH OF FORCE MAIN (MI) |
|---|---|---|---|---|---|
| RACINE | WISCONSIN | NORTH PARK SS | 10000 | 8.2 | 4.0 |
| RICHLAND CENTER | WISCONSIN | RICHLAND CENTER SE | 5100 | 4.0 | 1.0 |
| ROTHSCHILD | WISCONSIN | ROTHSCHILD SS | 5000 | 0.0 | 0.0 |
| SO MILWAUKEE | WISCONSIN | SO MILWAUKEE SS | 23487 | 4.9 | 0.6 |
| STURGEON BAY | WISCONSIN | STURGEON BAY SS | 7000 | 0.0 | 0.0 |
| SUPERIOR | WISCONSIN | SUPERIOR SS | 32000 | 0.0 | 0.0 |
| TOMAH | WISCONSIN | TOMAH SS | 5700 | 2.0 | 0.0 |
| WATERTOWN | WISCONSIN | WATERTOWN SEWERS | 16000 | 4.0 | 0.0 |
| WAUKESHA | WISCONSIN | WAUKESHA SEWERS | 49500 | 27.0 | 0.0 |
| WAUKESHA | WISCONSIN | WAUKESHA SS | 50000 | 14.4 | 9.0 |
| WAUSAU | WISCONSIN | WAUSAU SS | 40000 | 3.0 | 2.0 |
| WISCONSIN DELLS | WISCONSIN | WISCONSIN DELLS SS | 3000 | 6.0 | 2.0 |
| CASPER | WYOMING | CASPER SS | 51000 | 2.8 | 0.4 |
| JACKSON | WYOMING | JACKSON SS | 6000 | 4.3 | 0.0 |
| KEMMERER | WYOMING | KEMMERER SS | 3700 | 99999.0 | 0.0 |
| RIVERTON | WYOMING | RIVERTON SS | 12000 | 0.0 | 0.0 |
| ROCK SPRINGS | WYOMING | ROCK SPRINGS SS | 25950 | 99999.0 | 0.6 |
| TETON VILLAGE | WYOMING | TETON VILLAGE SS | 1212 | 0.5 | 0.2 |
| THERMOPOLIS | WYOMING | THERMOPOLIS SS | 6300 | 99999.0 | 0.2 |